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JPRS Report

Science & Technology

USSR: Computers

JPRS-UCC-87-016

16 SEPTEMBER 1987

SCIENCE & TECHNOLOGY

USSR: COMPUTERS

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/9835

JOINT SOVIET-NORWEGIAN COMPUTER DEVELOPMENT

Moscow VECHERNAYA MOSKVA in Russian 27 Mar 87 p 1

[Unsigned article, under the "Norwegian Computers" rubric; Norwegian Firm "West International" Specializes in the Delivery of Computer Equipment]

[Text] Close, mutually beneficial contacts with their Moscow colleagues have been maintained for 10 years now. A system for managing the case history of patients and observing them was developed jointly with scientists and experienced workers of the Institute of Cardiovascular Surgery imeni A. N. Bakulev. The Electronic Controls Machine Institute; the USSR Academy of Sciences; the Ministry of Instrument Making, Automation Equipment, and Control Systems; and the USSR State Committee for Science and Technology are among the firm's capital partners.

Leif Halvorsen, the firm's president, talked about this at a press conference. He arrived in Moscow to participate in the "West International" firm's symposium for Moscow specialists.

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CSO: 1863/280

SM-1700 COMPUTERS IN PRODUCTION

Moscow EKONOMICHESKAYA GAZETA in Russian No 16, Apr 87 p 1

[TASS article with photograph by V. Usinavichyusa]

[Text] Lithuanian SSR. The collective of the "Sigma" production association has begun manufacturing fourth generation SM-1700 computers. This required improving the quality and increasing the accuracy not only of products being manufactured, but also of components. In this connection the shop for printed circuit boards, on theedesign standard of which the quality of all products depends, was renovated at the Taurage computer components plant without stopping production. Following renovation of the shop, annually here they will produce almost twice as many printed circuit boards as before, and the number of workers will be reduced.

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'LVOV' PERSONAL COMPUTER IN PRODUCTION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 28 May 87 p 2

[Article by M. Kryslach in Lvov: "The 'Lvov' Personal Computer"]

[Text] Specialists from the Lvov Production Association imeni V. I. Lenin have developed and manufactured the "Lvov" personal computer. It can be used in laboratories, training classrooms, production, and everyday life.

Everyone will be able to work with the computer, and special training is not necessary for this. The "Lvov" will be able to draw up a family budget and menu, store culinary recipes, and occupy children with logic games and entertaining programs. The new item transmits graphics on the screen in four colors and it can draw the shape of any configuration. Its memory capacity is 64 kilobytes, and that is considerably larger than many other models of home personal computers.

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NEW INTERACTIVE COMPUTER KEYBOARD ANNOUNCED

Kiev RABOCHAYA GAZETA in Russian 13 Mar 87 p 1

[Article by RABOCHAYA GAZETA correspondent in Kharkov: "Dialogue With a Computer"]

[Text] A basically new keyboard for dialogue with an EVM [computer] has been put in production at the "Orgtekhnika" [office facilities, devices, and equipment] association.

Microcircuits with an increased degree of integration and microprocessor equipment are the basis of the product. The keyboard is designed for managers in working with "Iskra" type personal computers, and it can be used at designer's automated work sites too.

The operator loads the digital character system in the computer by means of a device, and it either immediately provides an answer to a stated question or it assumes a mode of operation according to the selected program.

The keyboard that was put in production does not have counterparts. It is 50 times more long-lasting than foreign ones. Moreover, it accurately checks the information being loaded and rejects erroneous information.

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ECHO PROCESSORS; SIGNAL PROCESSING AIDED BY NUCLEAR AND SPIN ECHO

Moscow NOVOYE V ZHIZNI, NAUKE, TECHNIKE: SERIYA RADIOELEKTRONIKA I SVYAZ in Russian No 2, 1987 (signed to press 2/25/87) pp inside cover, 1-5, 64

[Annotation, foreword, and table of contents from book "Echo Processors; Signal Processing aided by Nuclear and Spin Echo" by Vyacheslav Sergeyevich Barsukov, candidate of technical sciences. Izdatelstvo: "Znaniye", 51,630 copies, 64 pages. Barsukov is author of 60 scientific works and 13 inventions in the area of electronics and microprocessor hardware.]

[Text] ANNOTATION

The brochure gives, on the basis of contemporary presentations in popular form, a systematized exposition of the theory of the appearance of the nuclear and electron spin echo. The principles of operation are examined, as are the significance and possibilities of using multi-function quantum devices for processing radio signals (the echo processors) in a contemporary radio-electronic device.

The brochure is designed for lectors, attendees and teachers who are interested in perspectives on the development of functional electronics in the area of processing and storing information.

FORWARD

It is well known that at the present time digital processing of signals is quite effectively being used, the introduction of which was aided by the achievements of microelectronics in computer hardware, in particular the improvement of microprocessors and personal computers (PC). The heart of a PC is a digital processor (microprocessor), which actually carries out all necessary operations (arithmetic, algebraic, logical, etc.) on all digital information which comes as input to it. The transfer to digital methods of processing signals has allowed substantial improvement of the basic technological characteristics of microelectronic hardware (reliability, adaptability to manufacture, etc.) However, this transfer did not occur without some loss. Potentially, analog processing (using analog processors) allows a few orders of magnitude (10 to 1000 times) improvement in size, frequency, and energy characteristics of microelectronics hardware, and in raising its high speed of operation. One of the representatives of these analog processors is the echo processor.

What is an echo processor, how does it work, what prospects are there for its use? The interested reader will find detailed answers to these and other questions at the end of the brochure. Here let us briefly note that an echo processor in the general view is represented as a solid-state body which provides the processing of analog signals on the basis of echo-signals. Depending on the physical manifestations used, it can be accomplished in the form of a magnetic-core coil, a piezoelectric condenser, a ruby crystal, and so forth (using nuclear spin echo, phonon echo, and photon echo, respectively). As a coarse analogy, one can compare the process of echo-signal processing with the spread of an echo in the mountains. In this case, an acoustical wave from the broadcast source, for example a man, reflecting from the vertical slope of the mountain, returns after a definite period, called the echo-signal delay time. Changing the distance from the reflecting surface, one can change (regulate) the delay of the echo-signals. Using this analogy, one can say that for a nuclear spin echo processor presented as a magnetic core with three windings, the first winding fulfills the functions of the source of radiation, the second--that of the receiver, and the third--the reflecting surface. For this reason, changing the moment of advance of the reflected impulse on the third winding, one can regulate the echo-signal delay. As we will show later, what is at first glance such a simple construction allows us to implement all fundamental aspects of processing radio signals (delay, compression, correlation processing, optimal filtration, and so forth).

An echo processor is a multi-functional quantum device for processing signals which has great potential possibilities. At the current time some of these possibilities of echo processors are already successfully being employed in practice in such areas as radar, communications, medicine, measurement technology, and so forth. However, it is necessary to note that in the process of practical introduction of echo processors, a few difficulties were met, whose final resolution has not yet been accomplished. The mechanisms of echo manifestations have not yet been discovered, nor have there yet been found highly effective working materials for echo processors. The pace of the practical, sufficient introduction of echo processors into the economy, a pace which does not meet the needs of today, is explained also by the inadequate appearance in print of the results of scientific research in this subject.

The presented material is designed for the familiarization of a wide circle of readers with the principles of operation, significance, and possibilities for use of multi-functional quantum devices for signal processing (echo processors) in contemporary electronic equipment. The analysis which is carried out, and the systematization of materials dedicated to the methods of using echo processors, make this useful both for the specialists whose interests are connected with the practical use of the appearance of resonance in radio signal processing devices, as well for specialists of related fields who are interested in the development of functional electronics.

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UDC 681.14

COVERAGE OF LOGIC CIRCUITS BY MODULES OF CERTAIN SERIES-PRODUCED SYSTEMS

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 6 Jul 83)
pp 34-38 (43)

[Article by G.P. Agibalov and A.M. Oranov]

[Abstract] A study is made of circuits and free modules constructed of elements of a certain subset in which a coverage ratio is assigned, meaning that any element of a circuit in the set can be replaced by an element from a covering set without requiring a change in the organization of the circuit or the function that it performs. The problem is, for a fixed system of free modules and circuits in the set, to construct the shortest coverage of the circuit using elements from the other set. An algorithm is presented for solution of the problem for the so-called base system of free modules consisting of all modules of System 133 and 2 modules of System 136 in the Soviet semiconductor element numbering system. Figure 1; references: 4 Russian.

6508/9835
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BRIEFS

SOVIET 'FIFTH-GENERATION COMPUTER' -- Minsk scientists and designers have succeeded in creating, using serial computers and various peripherals, a machine complex having no analogues elsewhere, endowed with all the marks of a fifth-generation computer. It performs the most complex tasks of planning and departmental management, "talks" with a person, sees objects, reads designs and other graphic information... And all this without operator assistance. The computer is set up at the BSSR Minzhilkommunkhoze [Ministry of Public Housing]. [Text] [Moskovskaya Pravda in Russian 3 Aug 86 p 3] 13264

CSO: 1863/27

BOOK ON SOFTWARE

Moscow NOVOYE V ZHIZNI, NAUKE, TECHNIKE: SERIYA RADIOELEKTRONIKA I SVYAZ (PROGRAMMNOYE OBESPECHENIYE EVM) in Russian No 3, 86 pp 1-2, 64

[Annotation and table of contents from the book by V. A. Vasilenko "Computer Software," Radioelektronika i Svyaz No 3, Izdatelstvo "Znaniye", Moscow 1986, 46,010 copies]

[Text] Annotation

The main problems in software development are considered in this booklet. The reader acquires concepts relative to program production quality and learns about evaluation methods. Special attention is given to standard methods of program testing.

This booklet is intended for readers interested in computer technology as well as for lecturers, students, and teachers in national universities.

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12863/9835
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UDC 681.142.2

SUBROUTINE SYSTEMS AND FACILITIES FOR INTERACTING WITH THEM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 293, No 3, Mar 87
(manuscript received 20 Nov 85) pp 545-549

[Article by A. N. Biryukov and I. M. Mikhaylik]

[Abstract] A study is made of a finite set of subroutine specifications, describing a system of subroutines for performance of a class of tasks when called by application programs. A programming technique is assumed which allows the subroutines to be called by application programs such that the application program need not be modified if the internal procedure or capability of a subroutine is changed. The programming technique at least partially avoids these difficulties by localizing the rules for interaction with systems of subroutines, so that the application programs need contain no information concerning the rules. Changes in a model thus do not require changes in the application programs which call the subroutines. This approach at the very least allows definition of a class of "safe" changes to subroutines, not requiring modification of the application program. The analogy is noted between this system and data base management systems, with the subroutine system model acting as the data base system, while the operations of interaction with the model act as the data base manipulation language. Reference: 1 Russian.

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UDC 519.854.33.6

THE RANETS-1 APPLICATION SOFTWARE FOR APPROXIMATE SOLUTION OF THE GENERALIZED KNAPSACK PROBLEM

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 9 Jan 84)
pp 105-108

[Article by A. A. Aliyev, F. B. Akhmedov and Dzh. A. Babayev]

[Abstract] The RANETS-1 [Russian for Knapsack-1] software was developed at the Institute of Cybernetics, Azerbaydzhm Academy of Sciences, and is intended for solution of the generalized knapsack problem, among the most important classes of discrete optimization models utilized in optimal planning and administration of complex technical and economic systems. The software includes the following algorithms: Stepwise maximization relative to the increment of a functional, nonlinear penalty method, method of successive assignment of nulls and two algorithms for improvement of a permissible solution. The structure and composition of the software are briefly described. References 9: 6 Russian, 3 Western.

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UDC 519.8

METHOD OF LOCALIZING THE AREA OF THE OPTIMUM IN MATHEMATICAL PROGRAMMING PROBLEMS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 293, No 3, Mar 87 (manuscript received 21 Nov 85) pp 549-553

[Article by A. F. Voloshin, Kiev State University, imeni T. G. Shevchenko]

[Abstract] An approach is suggested for solution of a broad range of mathematical programming problems including continuous integer and mixed problems based on sequential analysis and screening of various versions to generate a constructive description of the area of the optimum of the problem. References: 10 Russian.

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UDC 62-50:517.9

THE MAXIMUM PRINCIPLE FOR CONTROL SYSTEMS DESCRIBED BY DIFFERENTIAL EQUATIONS IN DISTRIBUTIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 291, No 3, 1986 (manuscript received 17 Jun 85) pp 560-562

[Article by Yu. V. Orlov, Institute of Control Problems, Moscow]

[Abstract] A study is made of the problem of optimizing dynamic systems in a situation when the controlling action is a zero-order distribution. The correctness of the maximum principle inintegral form is demonstrated for a new class of optimal control problems of systems described by differential equations in distributions. In concrete problems, the principle can generally be used to produce constructive procedures for generation of an optimal control. References 8: 7 Russian, 1 Western.

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EFFECTIVE ALGORITHM FOR DETERMINISTIC PROBLEM OF SCHEDULING THEORY WITH PARALLEL DEVICES

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 20 Oct 83) pp 120-122

[Article by Ya. A. Zinder]

[Abstract] Suppose a queuing system with two identical devices must serve a finite set of requests N. Servicing of each request can be performed by either device and occupies one unit of time. A device can service just one request at a time, and cannot be interrupted once servicing has started. An effective algorithm is known allowing construction of an optimal schedule if all requests arrive simultaneously. This article presents an effective algorithm for the same problem assuming partial ordering of the set of requests and limitations in terms of the moments when servicing of requests can be started and completed. References: 3 Western.

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UDC 517.977.56

PULSE-POINT CONTROL OF PSEUDOPARABOLIC SYSTEM

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 2 Feb 84) pp 116-117

[Article by S. I. Lyashko]

[Abstract] Many applied scientific and technical problems require the study of processes described by pseudoparabolic equations. A previous study covered the problem of point control of systems described by pseudoparabolic equations. This article studies the same problems for the case when the right portion of the pseudoparabolic equation is a generalized function with respect to both space and time variables. References 6: 4 Russian, 2 Western.

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UDC 518:512.25

ALGORITHM OF SINGULAR EXPANSION FOR MULTIPROCESSOR COMPUTERS WITH PARALLEL COMPUTATION

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 13 Mar 84) pp 99-102

[Article by Kh. D. Ikramov and I. N. Molchanov]

[Abstract] There are many algorithms for computation of singular numbers and singular expansion of rectangular matrices. This article describes a numerically stable parallel scheme for singular expansion, the method of unilateral orthogonalization suggested by M. R. Hestens. The modification suggested by the authors achieves greater productivity but encounters problems of organization of the Jacobi cycle. In contrast to the Golub-Reinsch algorithm, the Hestens algorithm can be implemented on single-processor computers using peripheral disk storage. References 13: 7 Russian, 6 Western.

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CSO: 1863/194

UDC 519.853.62

PROPERTIES OF DIFFERENTIABLE MULTIVALUED MAPPINGS

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 31 Aug 83) pp 77-79

[Article by V. G. Bondarevskiy and L. I. Minchenko]

[Abstract] Multivalued mappings have been widely used in optimization and mathematical economics. This article utilizes the definition of differentiability from a previous study to prove the theorm of differentiability with respect to direction of the maximum function in multivalued differential mappings produced earlier with several additional assumptions concerning the multivalued mapping. References 13: 10 Russian, 3 Western.

6508/9835
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UDC 519.853.62

COMPUTATION OF MARGINAL FUNCTION SUBDIFFERENTIALS

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 8 Aug 83)
pp 72-76

[Article by L. I. Minchenko]

[Abstract] Previous works have constructed the subdifferential calculus of nonsmooth functions without using classical derivatives with respect to directions. This brings up the problem of computation of generalized gradients or subdifferentials of Clarke and the subdifferentials of Pshenichnyy of marginal functions. This work is dedicated to computation and estimation of subdifferentials and generalized marginal function gradients if the multivalued mapping F is a Lipschitz mapping. References 20: 11 Russian, 9 Western.

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UDC 517.27

CONVERGENCE OF METHOD OF CHEBYSHEV CENTERS AND SOME OF ITS APPLICATIONS

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 21 Jan 84)
pp 60-65

[Article by E. I. Nenakhov and M. Ye. Primak]

[Abstract] A study is made of a class of methods of Chebyshev Centers with geometric rate of convergence with controlled progression denominator. One of its specific implementations, a dual method of cleavage, is also studied, as is the closely related modular method of convex programming. References 11: 8 Russian, 3 Western.

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UDC 519.85

FINITE METHOD OF MINIMIZING CONCAVE FUNCTION WITH LINEAR LIMITATIONS AND ITS APPLICATIONS

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 15 Oct 84)
pp 49-53

[Article by Chan Vu Tkhyeu]

[Abstract] A finite method is suggested for minimizing a concave function with linear limitations and the possibility of its application to the solution of certain important problems in mathematical programming is studied. Results of a computer experiment are presented. The applications include a problem in bilinear programming, a linear problem of complementarity and a problem in concave programming with a special structure. Figure 1; references 8: 1 Russian, 7 Western.

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UDC 519.17

PROBLEM OF MINIMAL BLOCKING FLOW IN A NETWORK

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 30 Dec 82)
pp 44-48

[Article by V. V. Malyshko, deceased, and F. Kharari]

[Abstract] A study is made of a flow in a non-oriented network having the additional property of "blocking," meaning that, in any circuit from source to sink, an edge is found for which either the flow is equal to the throughput capacity or the direction of the flow is opposite to the direction of transmission of the edge in the circuit. It is proven in this work that the problem of determining the minimum blocking flow is an NP-complete problem. An approximate polynomial algorithm is suggested for its solution, consisting in the transmission of a unit of flow along a path utilizing more than one edge of a certain minimum reserve separating the source from the sink. It is proven that if classes P and NP do not coincide, there is no approximate polynomial scheme for solution of the problem of the minimum blocking flow. Figures 7; references 7; 6 Russian, 1 Western.

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UDC 518:517.946

NUMERICAL SOLUTION OF DIFFERENTIAL PARABOLIC SECOND ORDER EQUATIONS ON COMPUTERS WITH PARALLEL ORGANIZATION OF COMPUTATION

Kiev KIBERNETIKA in Russian No 2, Feb 86 (manuscript received 25 Feb 83) pp 30-33

[Article by I. N. Molchanov and V. N. Brusnikin]

[Abstract] A study is made of paralleling of known theoretically well-founded difference schemes for solution of parabolic second order differential equations on multiprocessor multi-instruction, multi-data-flow computers with parallel organization of processing and limited computer resources in the form of fixed speed, memory volume and speed of data exchange among processors. Figures 4; references 10: 9 Russian, 1 Western.

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UDC 62-50

OPTIMIZATION APPROACH TO CONTROL OF SYSTEMS WITH UNDEFINED DYNAMICS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 291, No 5, 1986 (manuscript received 24 Feb 86) pp 1075-1079

[Article by S. V. Yemelyanov, academician, S. V. Nikitin and V. I. Sizikov, All Union Scientific Research Institute of Systems Research, Moscow]

[Abstract] An approach is suggested to synthesis of a control under conditions of uncertainty, based on reducing the problem to one of minimizing a certain function estimating the deviation of the dynamics of the controlled processes from the assigned dynamics. The assigned dynamics correspond to the dynamics of an object closed by a certain control which compensates for parametric disturbances in the system under conditions such that full information is available on the controlled process. The problem is one of minimizing the function $\varphi(t,x)$ with respect to $u(t,x) \in U$ in solutions of an S_c system, where U is the class of permissible controls. Gradient minimization and algorithms for control of systems with variable structure are studied for solution of the problem. The approach suggested is applicable to other types of dynamic systems, including nonlinear systems with uncertain dynamics, undefined nonlinear systems with aftereffects, etc. The optimization approach to the synthesis of controls in undefined processes allows analysis of various control methods under conditions of uncertanty as various methods of minimizing a certain function of the coordinates and status of the system and its parameters. The approach creates a basis for development of new methods of

synthesis and control algorithms, allowing composition of various algorithms and standardization of the process of planning control systems. References: 12 Russian.

6508/9835
CSO: 1863/220

UDC 62-50

ANALYTIC CALCULATION OF MULTIVARIATE SYSTEM TRANSFER FUNCTION COEFFICIENTS

Moscow DOKLADY AKADEMII NAUK SSR in Russian Vol 290, No 3, 1986
(manuscript received 12 Jun 85) pp 557-559

[Article by S. F. Babak, B. G. Ilyasov and V. Yu. Rutkovskiy, Ufa Aviation Institute imeni Sergo Orgzhonikidze, Institute of Cybernetics imeni V. M. Glushkov, Ukrainian Academy of Sciences, Kiev]

[Abstract] Known methods of finding the transfer functions of multivariate systems do not allow the coefficients to be represented as explicit functions of the parameters of a complex system. This article solves this problem using a method based on representation of the system as a weighted, oriented pseudograph. An equation derived in the article establishes the variation of individual coefficients of the transfer functions with parameters of the system in explicit form. The method of calculation is particularly desirable when it is necessary to perform repeated computation of coefficients of transfer functions while preserving the structure of the system unchanged. The method has no limitations on degeneration of the matrix of coefficients with high order derivatives in the initial equation system. Reference: 1 Russian.

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ARTIFICIAL INTELLIGENCE: NEW STAGE OF DEVELOPMENT

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 4, Apr 87 pp 40-47

[Article by Doctor of Technical Sciences D.A. Pospelov]

[Text] An article titled "Artificial Intelligence" was published in the pages of this journal 12 years ago (1). In it we, together with G.S. Pospelov, wrote about a then new scientific trend whose very right to existence still had to be defended. Its name, which sounds pretentious in Russian, had to be apologized for. The opponents of artificial intelligence (few, to be sure) then considered research in this field a waste of time, and the skeptics (of which there were quite a few) considered it without prospects, at least for the next few decades. But science develops according to its own objective laws, which are independent of subjective assessments and opinions, although excessive skepticism and distrust towards this or that research can hamper the obtainment of new results. Unfortunately, something like this did happen with research in the field of artificial intelligence in our country. It developed more slowly than in the leading countries of Europe and in Japan. Therefore, the boom which arose in the field of intelligent systems at the beginning of the 80's was somewhat unexpected for us (and not only for us).

What happened? To answer this question briefly, it must be said that research in this field at the beginning of the 80's led to the development of the first models of industrial and commercial intelligent systems. These systems turned out to be a very fast-selling commodity, the demand for which is growing rapidly. There are several reasons for this, three of them being the most important.

It became clear by the middle of the 70's that the barrier which exists between the nonprogrammer user and the computer was hindering the further spread of computer equipment and its transformation into a mass-consumption item as at present. Many specialists, understanding that the use of computers would make it possible to increase the efficiency of their work considerably, did not have the ability or desire (or both) to spend time on learning programming and solving problems on a computer. There was only one way out of the situation where the shortage of professional programmers was growing rapidly, and their training was not keeping up with the production of computers and was requiring an ever greater number of people. It consisted in the development of software and hardware which would be able to assume the

task of programming, thereby facilitating to the maximum communication between users and computers.

The conception of new generations of computers was based on this idea, and the famous Japanese fifth-generation computer project was the first sign here. In this project the idea was formulated clearly for the first time that it should be just as simple to use a fifth-generation computer as to use modern home appliances of the video cassette recorder or washing machine type. Similar projects in Great Britain, the USA and France followed the Japanese project. International projects sprung up, the most well known of which is the ESPRIT project, which united scientists and engineers from all the leading countries of West Europe. The goal of all these projects was the development of what is now customarily called an "intelligent interface."

An intelligent interface is made up of three principal components: the knowledge base, solver and communication system. With the presence of an intelligent interface the user can communicate with the computer in an ordinary limited natural language oriented toward the problem area of interest to the user. Almost all the ambiguities and failures to tell all characteristic of a natural language at its fullest are absent in this language. Academician A.P. Yershov quite aptly called languages of this type "business prose." The user words the goal of interest to him and assigns the initial parameters of the problem in the language of business prose. In other words, communication between the user and computer in this case resembles how one specialist communicates with another who has been assigned to do a specific job.

The communication system analyzes the text input into the computer, separates the user's assignment and the set of initial data from it and converts this assignment and the corresponding data into the internal machine representations which are "understood" by the remaining units of the intelligent interface. The initial assignment prepared in this way enters the unit called the solver. Its task is to synthesize a working program based on the initial assignment. It does the job that the programmer does now when he receives from a specialist an assignment to solve a problem. The solver is a sort of "automatic programmer." And since programming is a creative intellectual process, then the solver must possess the knowledge to help it cope with the task of synthesizing the working program. This knowledge is stored in the knowledge base. It is divided into two parts, as it were: knowledge on the problem area, and knowledge on how working programs are written on the basis of initial assignments. The first layer of knowledge is comprised of information on the relationships, laws and rules characteristic of the field of activity in which the problem is being solved. If this field is electrical engineering, then all the relationships used in calculations (e.g., Kirchhoff's law or Ohm's law), as well as all information concerning the applicability of specific relationships under the conditions formulated in the assignment, should be stored in the knowledge base. A library of standard modules representing functionally complete programs making it possible to solve standard problems in a given problem area is stored in the same part of the knowledge base. These programs are written beforehand and are placed in the computer's knowledge base. Let us note, incidentally, that in the dictionary present in the communication system, about which we already spoke,

there is a list of all the key concepts characteristic of a given problem area and which can be encountered in formulation of the task input into the computer by the user (e.g., concepts such as a capacitor, current, impedance, etc., should be in this dictionary for a problem from the field of electrical engineering).

Procedures for synthesizing programs from ready standard modules on the basis of the problem-solving assignment are stored in the second layer of knowledge. These procedures can depend on the specifics of the problem area, reflecting the features of methods of solving problems in it. But the majority of them are problem-independent, reflecting the general features of programming.

In using all this knowledge, the solver either uses a ready standard module for fulfilling the user's request, by adding to this module the initial data input by the user, or it forms from these modules a complex program, by interfacing modules with respect to data and control. The finished working program from the solver enters an ordinary processor, which executes the program. The answer found is output to the user via the same communication system. The form of the answer is such that the user receives it in the form to which he is accustomed.

We have discussed how an intelligent interface functions, without which the transition to new generations of computers is unthinkable. The principal features of these systems is the presence of special knowledge on the field in which problems are solved and on the methods by which they are solved. In other words, the operation of intelligent interfaces is based on knowledge. The appearance of knowledge in a system's memory marked the transition from ordinary program systems to intelligent ones. Whereas in ordinary program systems the user must enter into the computer the program for solving his problem, in intelligent systems he has to indicate just the type of problem and the initial data which are of interest to him, and the solution program will be generated in the system automatically, or, in complex cases, in the interactive mode--by the user and system together.

Of course, intelligent program systems did not spring up at once. They grew gradually out of ordinary systems. The appearance of libraries of standard subroutines was the first step along this way. The development of packages of application programs with advanced package control facilities was the second step. The appearance of data bases made it possible to use them for storing information organized rather complicatedly. Finally, the unification of ideas accumulated in the development of advanced packages of application programs and data bases led to the appearance of knowledge bases and solvers.

The need to develop intelligent interfaces and the importance of this problem for the further development of computer technology and the mass introduction of computers into all spheres of human activity constitute the primary reason for the burst of interest in research in the field of artificial intelligence. Research relating to the development of systems for the representation of knowledge and for manipulating it, and of interactive systems based on a natural language, and the planning of feasible behavior were concentrated precisely in this scientific trend. Specialists in the field of artificial intelligence were ready for this "social mandate" which came to them from the

developers of new generations of computers, and now they are working successfully on the development of intelligent interfaces which differ in their features and capabilities.

The second reason for the boom in the field of intelligent systems is of another nature. Since the very beginning of the appearance of computers, problems relating to fields often quite remote from mathematics, physics and engineering have been solved on them, in addition to traditional computing problems. The composition of music, the simulation of various games and the diagnosis of many illnesses are examples of such "non-computational" problems. In order for the computer to be able to be used in these fields, the programmer had to formalize the problem, reduce it to a machine program. After this, the solution on a computer of a set of differential equations essentially differed in no way from the composition of several musical pieces on it. The sphere of non-computational problems expanded steadily with time. It became clear that computational tasks per se, for which computers were developed, constitute not so great a percentage of the great number of problems which people have to solve and the automation of whose solution would be desirable. But it also became clear that a formalization barrier existed. A great number of problems solved successfully by specialists did not permit direct formalization and were not being converted into procedures which could be programmed by the standard method. The ability, which the specialist demonstrated, to solve specific problems in his field did not fit into formalized procedures, but was expressed in a totality of knowledge at first glance diversified and poorly interrelated.

This situation led to replacement of the old paradigm in the field of programming--"the procedures for solving a problem are primary, and the data for solving it are secondary"--by a new paradigm taken from the works of specialists in artificial intelligence--"knowledge is primary; the procedures for solving problems are secondary." This replacement of paradigms resulted in the fact that, in place of the problem of the programming of procedures, the problem arose of describing the necessary knowledge concerning the problem area, inputing it into the computer's memory and using it for the synthesis of programs. Another type of specialist--the knowledge engineer--appeared around the computer in place of the programmer.

He has become a central figure at today's stage of intelligence in the field of computers and their applications. The development of intelligent robots is impossible without his help, for they need a considerable store of knowledge in order to execute efficiently and independently the tasks entrusted to them, in a dynamic medium not described completely a priori. And he is especially important in the development of the now quite popular intelligent systems which have been called expert systems, whose appearance was the second reason for the boom in the field of intelligent systems.

Expert systems are designed for solving problems in poorly formalized fields of human activity (medicine, chemistry, geology, biology, archeology, etc.). In these fields there is no hope of developing sufficiently general and powerful mathematical models on whose basis it would be possible to solve problems by the method traditional for computational mathematics. The only method today for automating the solution of problems in these fields is

simulation of the activity of skilled specialists, who it is customary to call experts. Knowledge concerning the properties of problem areas and methods of solving problems in these areas is put into expert systems. This knowledge is entered into the computer's memory in the form in which it was obtained from the specialists, i.e., in the form of several non-formalized statements. The products widely used in expert systems in existence now are the most widespread form of these statements.

These products are expressions of the type: "If conditions P have been fulfilled and A takes place, then B must be done (take place), and after this it is necessary to add information C to the knowledge base." Here P plays the role of the condition for applicability of the rule formulated in the product, and C the role of the postcondition, whose fulfillment is necessary after the action of the principal part of the product. Let us illustrate this with a simple example.

Let information of the following kind be contained in the system's knowledge base at a certain moment of time in the system's operation: "Motor vehicle Z 84-86 MO is moving toward crossing K," where K is a certain crossing known to the system. The following product can act as the crossing is approached: "If the vehicle is approaching the crossing and it is not a special vehicle and the red signal of a traffic light is on in the direction of its motion, then it must stop," and after this the fact "motor vehicle X XX-XX XX is moving toward crossing X" must be replaced in the knowledge base by another fact: "Motor vehicle X XX-XX XX is standing before crossing X." Here by X we mean free variables which take on specific values when the product is used for a specific case.

It is assumed (and this has been confirmed in practice in the development of expert systems for various problem areas) that the knowledge of experts in very different spheres of human activity can be described by means of these products and that this form of the representation of knowledge is convenient for a knowledge engineer's being able to obtain this knowledge successfully from experts.

And so, the professional knowledge of leading specialists in non-formalized or poorly formalized fields is embodied in expert systems. But what is the purpose of storing this knowledge?

Expert systems can be used in two versions. In the first they serve as consultation systems. Their objective is to raise the average level of professionalism in the solution of specific classes of problems. Such a system can be used by a young geologist who has encountered for the first time an unknown situation in the description of a certain deposit, by a young physician who has difficulty in diagnosing a complicated illness, and by a not too experienced archeologist who is in doubt about dating an excavated stratum. An expert system, having received in its input the information at the user's disposal, processes it in accordance with the goal the user wants to achieve, and if the information is sufficient for an unambiguous answer, then the answer is output to the user. If an answer cannot be gotten with the available information, then the system can ask the user a number of additional questions relating to the case in question. If the additional information

input by the user is sufficient, then he will get an answer to the question he is interested in. But it is quite possible that the system will continue its conversation with the user and store the information necessary for finding an answer.

Thus, an expert system is not simply a reference book where there are ready answers in systematized form. This approach would be simply unsuitable for complex fields. Expert systems in existence now have advanced logical inference facilities, for both certainty and likelihood (in particular, probabilistic). The system finds the required answer by means of these facilities.

A unique feature of all expert systems (whichever version they are used in) which distinguishes them from all other decision-making systems is their ability to explain how and on what basis the decision output to the user was arrived at. The user can request such an explanation from the system any time he doubts the correctness of the recommendation he has received. There is a special unit--the explanation subsystem--in expert systems for the purpose of forming explanations.

In the second version of the application of expert systems, they are used not by beginning researchers in a given field for the purpose of gradually accumulating experience and knowledge, but by experienced specialists. For them expert systems serve as a convenient tool for the automation of scientific research, make it possible to do away with many kinds of routine work, serve as a unique information reference book for results obtained by other specialists in this field, and sometimes render assistance of the same type as to inexperienced specialists. In this function of theirs expert systems play the role of facilities for the automation of scientific research or planning and design work.

The intelligent systems market of the present time consists principally of expert systems. There are also examples of these systems at the research stage (when they demonstrate only the ability in principle of solving the problems entrusted to them) and at the industrial and commercial stage, when they can be circulated and disseminated among potential users. There are now on the world market a few dozen different expert systems which have reached the industrial and commercial level. The most famous of these is the PROSPECTOR system, designed for working in geology. Its use made it possible to discover a rich molybdenum deposit in the USA (Washington State) in 1981.

In association with the fact that the areas of application of expert systems are quite varied (medicine, chemistry, geology, space research, designing SBIS's [superlarge-scale integrated circuits], archeology, the military, etc.), a number of firms have begun to produce so-called "shell" expert systems. They have all the necessary components and systems, but the knowledge base and communication system dictionary remain empty. Special facilities are added to the system for the purpose of filling the base and dictionary with information from the problem area which interests the potential user. The filling in can be done either by the user himself or by knowledge engineers working at the firm which produces the expert system in question.

The following figures tell how great the investment in expert systems is. In 1986 this investment equaled $16 million in the USA, $8 million in Japan, and $7 million in the countries of Europe, and, according to quite reserved forecasts, by 1990 this investment will grow by a factor of 100 to 200! Expert systems together with intelligent interfaces are now defining the level of scientific and technical progress.

A third reason for the boom in the field of intelligent systems is the addition of intelligence to programs which are already in existence. This is represented primarily by a rise in the intelligence level of various information systems. Systems furnished with advanced facilities for analyzing text requests and with advanced logic facilities for finding the required information in the computer's memory have arrived to replace descriptor, thesaurus and factographic systems. At the new stage work is growing in the field of word processing systems (in particular for automating the manufacture of printed products) and in the field of automatic abstracting systems and systems for translating from one language to another. Along the same direction research is growing and systems are being developed for automating office work (office systems) and for facilitating many domestic tasks (e.g., systems of the "notepad" or "telephone directory" type). And although the share of all these intelligent systems (relying in their operation on knowledge and not requiring programming by the user) is still not great as compared with intelligent interfaces and expert systems, it will become quite considerable in the very near future, for the market for these systems is very vast.

The appearance and wide use of intelligent systems has brought to life a new branch of industry. About 90 firms in the world are now already producing just intelligent systems, and another 70 firms are producing them together with other products. Research has expanded and production has been ironed out in the area of various tools to facilitate and hasten the production of these systems. These tools include various languages for the representation of knowledge and the manipulation of it, facilities for gathering information from experts, as well as systems for tailoring shell expert systems to the required problem area, and debugging facilities, interactive facilities and much more. This has shifted the development and production of intelligent systems onto an industrial track.

Everything said above relates to the development and spread of intelligent systems. One might get the idea that basic research in the field of artificial intelligence has disappeared in the current of this work. There are grounds for such an impression. If one analyzes the content of papers and presentations by specialists at numerous symposiums and conferences devoted to artificial intelligence in recent years, then it is possible to note a reduction in the percentage of studies of a basic theoretical nature and a considerable growth in applied research. This is possibly a natural reaction to the appearance of purely theoretical researach in the 60's and first half of the 70's. But it is possibly a consequence of the fact that numerous representatives of industry and other sectors for whom it is precisely applied results which are of the greatest interest have been interested in artificial intelligence.

Nevertheless, basic research in the area of intelligent systems has not stopped. Several new research trends have sprung up. Work in the area of the simulation of human reasoning and the development of standard models of behavior for artificial systems and of training them is actively growing, for example. New ideas based on the theory of discourse, which is actively growing in applied linguistics, have appeared in the area of interactive systems. New more efficient means of representing cognitive structures are being sought all the time in the field of knowledge engineering (where studies on the representation of knowledge and the manipulation of it have joined). Work on development of the architecture of hardware designed for solving intelligence problems is growing on a broad front. All this shows that the first wave of research in the field of artificial intelligence, which ended with the appearance of intelligent systems on the market, has been replaced by a second wave of theoretical research which apparently will conclude in the next few years with new results in the practice of the designing of systems having advanced intelligence capabilities.

In conclusion, we would like to touch upon a number of problems characteristic of the development of work in the field of intelligent systems in our country. As already mentioned, the skeptical attitude toward this most important field of computer science and technology could not but act as an inhibiting factor in their development. We have reached the mid-80's with results in this field which are considerably inferior to those obtained in the USA, Japan and in the advanced European countries. Work on the development of new generations of computers is rolling along here at a pace which is slower than the world level. Expert systems at the research stage can be counted in single numbers, and there are simply no industrial and commercial systems of this kind.

There are no academic or industrial institutes to fully concentrate their efforts in the area of the development of intelligent systems, and the existing specialized subdivisions are very small in number and have not been provided with computer hardware of the required quality.

The training of specialists in the field of artificial intelligence and intelligent systems is not being done in our country. Knowledge engineers are not being trained, without whom there is no hope of the broad introduction of intelligent systems into various spheres of the national economy. The USSR Academy of Sciences is still not coordinating to full effect research in the field of artificial intelligence. It is scattered and often duplicated. It is hoped that the recently made decision concerning the formation under the Department of Computer Science, Computer Technology and Automation of a special Scientific Council on the Problem of Artificial Intelligence is the first step on the way to solving this problem. It is necessary to arrange for a special journal for these problems (there are now more than 40 periodicals in the world specially devoted to problems of the theory of intelligent systems and the practice of developing them). All these measures should make possible in our country a fundamental sudden change in research on artificial intelligence, without which modern scientific and technical progress is impossible, as it was impossible in the 60's without computers.

FOOTNOTES

1. Cf. Pospelov, G.S. and Pospelov, D.A. "Artificial Intelligence," VESTNIK AN SSR, No 10, 1975.

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CONSTRUCTING MODELS IN ORGANIZING MANAGEMENT PROCESS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, Dec 86 pp 35-37

[Article by G. S. Goldenberg, engineer, and L. M. Khodorkovskiy, candidate of economic sciences]

[Text] The organizational-technological preparation of the management processes in the modern enterprise involves the necessity of formulating goals and structuring them by using a tree of goals right down to the level of individual measures and operations.

Modeling the sequence of implementation of these measures is the basis of planning; the experience gained allows determining the sequence and uncovering the content of the organizational-technological preparation of the management processes in the enterprise under the conditions of program-goal management.

The essence of the tasks to be implemented in the first phase is reduced to structuralization by using a graphic tree of goals of enterprise activity. An example of this structuralization is shown in fig. 1 in the goal subsystem "Management of Social Development of an Enterprise".

The complexity of the tasks associated with establishing and structuring goals in any goal subsystem, and in particular, in one such as management of social development of the collective in an enterprise, is quite obvious.

Proper definition of the ultimate goal and of the subsystem functioning criteria is a subject for special research. Nevertheless, when a goal has been formulated and structured and an outlet to specific measures defined at the last level of structuralization, problems associated with conveying the essence of the measures and the schedules for implementing them to the immediate performers in the production and functional subdivisions of an enterprise arise. It is therefore a question of the necessity of planning the activity of enterprise subdivisions to implement the goals formulated in any goal subsystem.

The goal tree (see fig. 1) has five ranks (levels). The main goal of the plan for social development, satisfaction of the social needs of the collective, has been formulated on level zero.

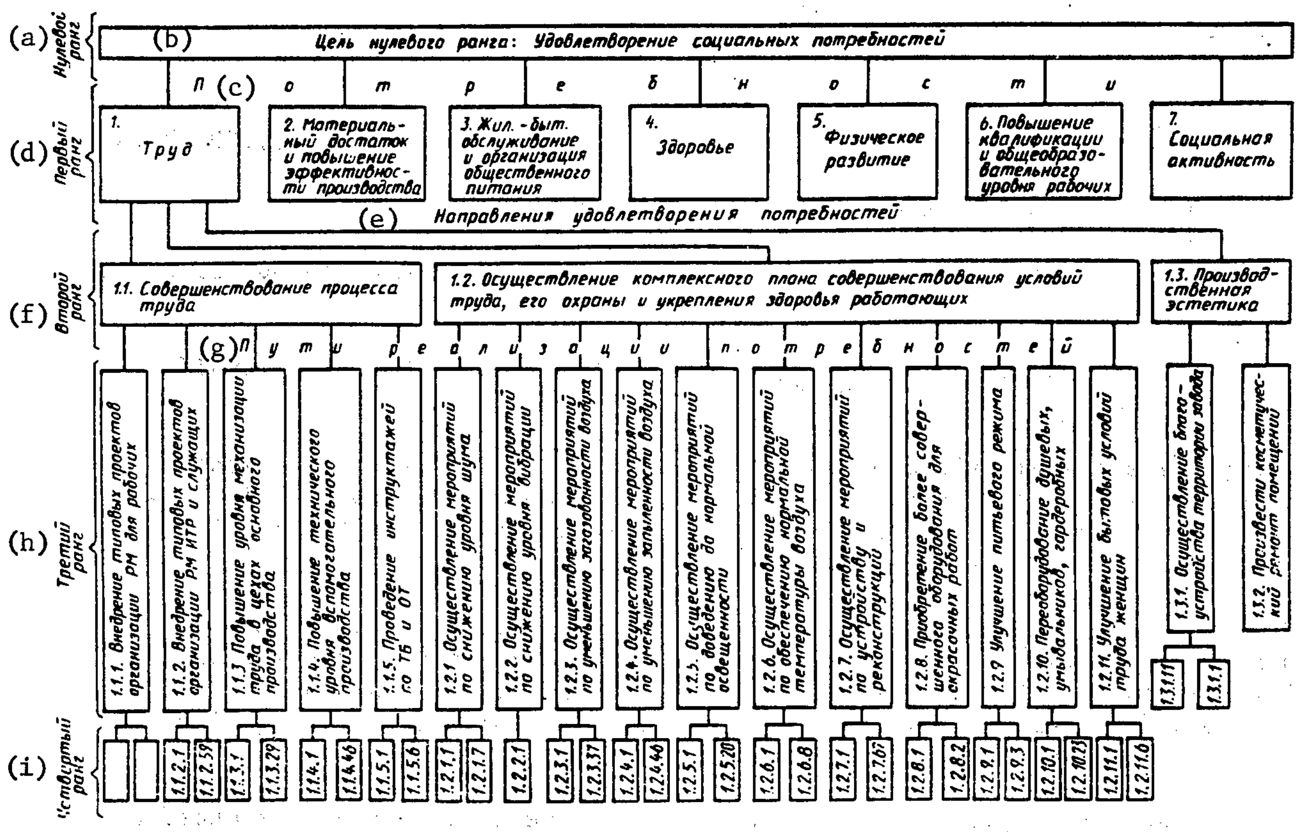


Fig. 1. Fragment of goal tree for subsystem "Management of Social Development of an Enterprise"

Key:

a. Level 0
b. Level 0 goal: Satisfaction of social needs
c. Needs
d. Level 1
e. Need satisfaction directions
f. Level 2
g. Ways to satisfy needs
h. Level 3
i. Level 4

1. Labor
2. Material sufficiency and increase in efficiency of production
3. Housing and consumer services and organization of public eating facilities
4. Health
5. Physical development
6. Increase in skill and general educational level of employees
7. Social activeness

[Key continued on following page]

[Key continued from preceding page]

1.1. Improve labor process
1.2. Implement integrated plan to improve working conditions, protect labor and strengthen the health of employees
1.3. Production esthetics
1.1.1. Introduce type designs to organize RM [working places] for workers
1.1.2. Introduce type designs to organize RM [working places] for ITR [engineers and technicians] and office workers
1.1.3. Raise level of mechanization of labor in basic production shops
1.1.4. Raise engineering level of auxiliary production
1.1.5. Hold briefings on TB [safety engineering] and OT [labor protection]
1.2.1. Implement measures to reduce noise level
1.2.2. Implement measures to reduce vibration level
1.2.3. Implement measures to reduce gas in the air
1.2.4. Implement measures to reduce dust in the air
1.2.5. Implement measures to attain normal illumination
1.2.6. Implement measures to attain normal air temperature
1.2.7. Implement measures on construction and modernization
1.2.8. Acquire more advanced equipment for painting operations
1.2.9. Improve drinking behavior
1.2.10. Reequip shower rooms, wash stands and cloakrooms
1.2.11. Improve routine working conditions for women
1.3.1. Put plant territory in good order
1.3.2. Perform cosmetic repair of premises

The goals on level one are represented by branches such as satisfying the need for meaningful labor, raising the material level, consumer and housing services and organization of public eating facilities, strengthening of health, physical development, raising the skill and general educational level of employees, and social activeness.

Going into further detail allows formulating goals on the second level as directions for satisfying the goals on the first level. For example, satisfying needs for meaningful labor is generated through directions such as improving labor processes and conditions and production esthetics.

Further detail on the third level defines the basic ways of satisfying needs, and on the fourth, allows defining the specific composition of measures to implement them (see fig. 1): improve working conditions, raise employee qualifications and vocational skill, general educational and cultural level, improve housing, cultural and living conditions, medical services, etc. These measures are worked out in accordance with the methodological recommendations for planning the social development of a collective of an enterprise and the experience of reorganization of social planning. It should be noted that there are 800 to 1,000 measures just in the subsystem in question.

They are compiled or supplemented on the basis of the systematized measures provided for in the drafts of the collective agreement, the plan for raising production efficiency and other plant-wide documents in which the problems associated with the satisfaction of the social needs of the workers are reflected.

The presence of well structured goals can be compared, for example, to a portfolio of orders carefully selected in an enterprise where the translation into actual products is the result of planning implemented according to specific models.

The necessity of converting the goal tree into a model to be used as the basis for planning the activity associated with implementing the measures planned is obvious. This model should afford the capability of distributing facilities and resources and defining schedules and those responsible for implementation.

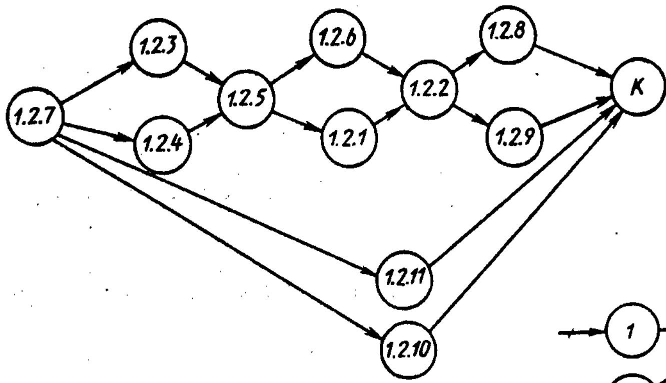
The most widespread technological model of some operation, i.e. a model which can be used as the basis for planning the operation, is the network model.

In this connection, the capability of translating the goal tree into a model affording the planning of managerial activity should be considered in the organizational-technological preparation of management processes. Such a model is generated from individual subgraphs united into a single network graph. For example, from the goals represented on the first level, let us take one for subsequent consideration, such as labor, and let us consider the process of forming a consolidated network graph consisting of individual subgraphs from the lower levels of the tree. In doing so, bear in mind that a consolidated network graph is constructed the same way for the other goals too. It is quite obvious that the consolidated graphs for each of them may be connected into a united network graph representing the upper level of the model. (Such an approach is also expedient when a unified model has to be constructed for all management subsystems).

As follows from fig. 1, the directions for implementing this goal on the second level are described by the branches 1.1, 1.2 and 1.3 which may be represented by a subgraph uniting these events in accordance with the logic for implementing them.

The content of each of the events on the second level in turn can be uncovered on the basis of the network subgraph generated with this goal; events on the third level are a variant of this subgraph.

In this network subgraph (fig. 2), that part of the vertices on the third level which reveals the ways to implement the integrated plan for improving working conditions represented in the goal tree by the code 1.2 (see fig. 1) is united for ease of illustration in accordance with the logically substantiated sequence.



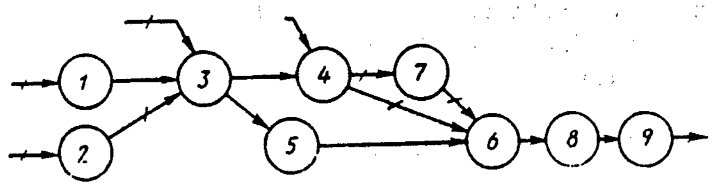


Fig. 2. Subgraph of goals on third level Fig. 3. Type procedure

Subgraphs revealing ways of improving processes of work and activity on improving production esthetics can be generated the same way. These goals are represented on the second level of the goal tree by the codes 1.1 and 1.3 (respectively).

The legitimacy of replacing the vertices of the graph shown in fig. 2 with the corresponding subgraphs is quite evident. Replacement can be continued until each of the vertices of the network graph on the level in question is replaced by the subgraphs corresponding to it; these subgraphs are compiled from the goals formulated on a lower subordinate level.

On the whole, the mechanism for subdividing the graph of the corresponding level remains unchanged even in going to any next level. The interrelation and sequence of implementation of specific measures affording implementation of goals on the third level are modeled in each of the subgraphs in going to the fourth level of the goal tree. These measures provide for implementation of single type operations: for example, for reducing noise and vibration levels, reducing dust in the air, bringing illumination up to the appropriate standards, introducing type designs of organization of workplaces in shops for basic and auxiliary production, etc.

They are grouped by features of the subdivisions into working fragments where the necessary operations are represented as events, for example: 1.2.5.1 is performance of work on improving natural illumination in an old building of shop No 11; 1.2.5.2 is improving the natural illumination of the transfer duct of the Southern branch of the heat route of shop No 19, etc.

It should be stressed that defining in detail the work on the fourth level of the tree produces a subgraph, the operations of which have the nature of materialized goals and are measured by labor and cost; they are addressed to the performers in the production subdivisions of the enterprise. Such operations are unavoidably tied also to managerial activity; therefore, subgraphs of the fourth level should be supplemented by operations which

reveal the essence of the management apparatus actions being implemented in the process.

Thus, the type procedure fragment (fig. 3) can be used for operations on the fourth level associated with organization of type work places and being implemented by measures to reduce the level of noise, vibration, dust, etc.

Those operations in it are the ones which reflect management apparatus actions for preparation and implementation of the measures listed above. These include the following (see fig. 3):

1. Analysis (of equipment of work places, illumination, level of vibration, noise, etc.).

2. Inspection (of layouts of work places for subject of correspondence to OST [All-Union Standards], GOST [State Standards], etc.).

3. Selection of drawings of machinery, equipment, etc.

4. Opening of order and registration of orders.

5. Drafting of recommendations on placement of equipment and machinery in accordance with existing standards and requirements of NOT [scientific organization of labor].

6. Arrangement of equipment and machinery in accordance with recommendations and layouts.

7. Preparation of machinery.

8. Introduction.

9. Computation of economic effectiveness and registration of event of introduction.

All branches and levels of the goal tree (see fig. 1) can be analyzed and a fragment of the network graph for social development generated this way.

When necessary, the operations associated with introduction can also be revealed through the management apparatus actions recommended in this connection.

On the whole, after the translations, the subgraph looks like the one shown in fig. 4. It is quite evident that the subgraphs obtained this way may be connected among themselves by alternative connections into a unified graph which affords performing multivariant computations and selection of a planned solution approaching the optimal.

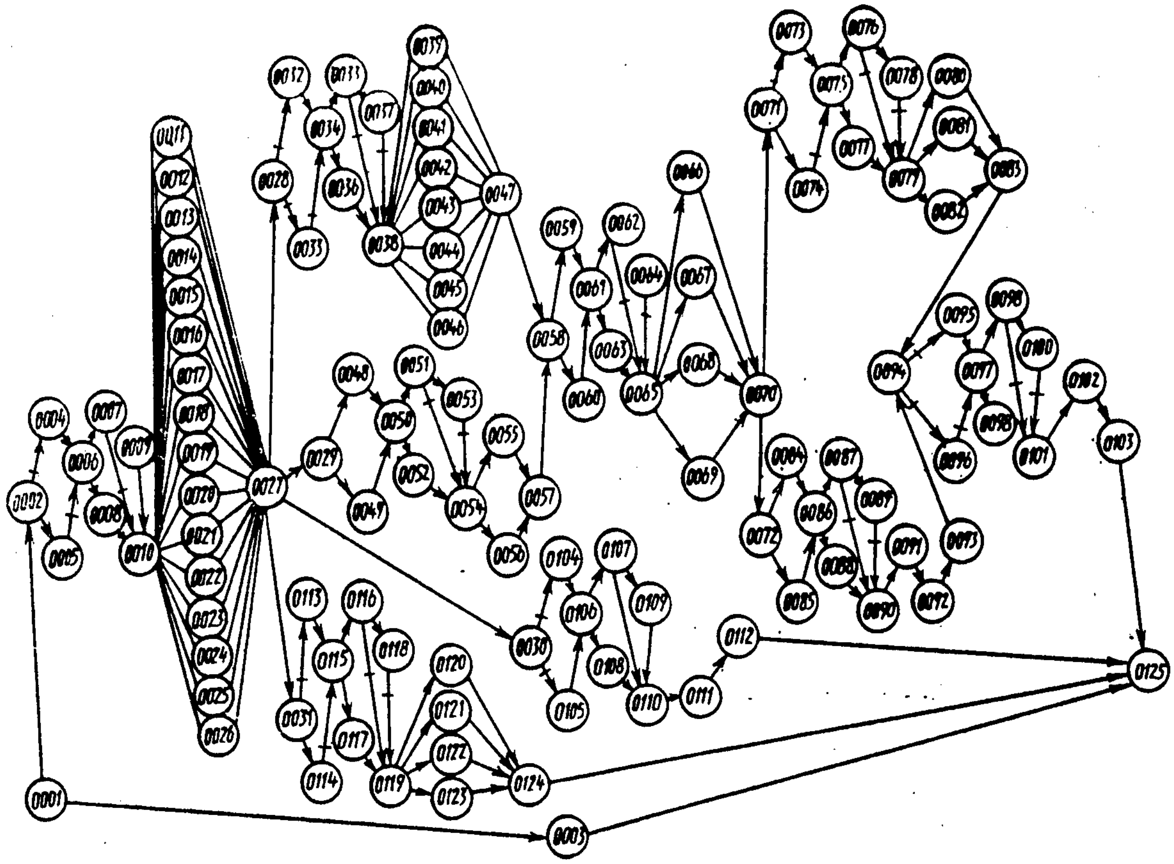


Fig. 4. Network graph obtained as a result of translation of fragment of goal tree

Thus, the processes of generating fragments of a goal tree and network subgraph for the goal program "Social Development of an Industrial Collective" have been considered in the article.

Seven goal programs for various classes of goals are now being generated in the enterprise. These include "Management of Scientific and Technical Progress," "Management of Quality," "Management of Fulfillment of Plan for Production and Delivery of Products" and others.

Standard forms for input documentation have been developed to automate the process of generating the goal tree and constructing directed graphs by the technique presented in the article.

Considering that the enterprise has long functioned under the conditions of an automated management system, the organizational problems associated with introduction of program-goal methods of planning and management are being efficiently resolved within the scope of the office for organization of management and document turnover. Collective agencies for goal management, working commissions for the directions, headed by deputies of the enterprise director, have been established. They generate goals on the top level and coordinate defining them in detail by using the methods of systems analysis. The time for completion of operations is determined from the network graph constructed on the basis of the goal tree by using a computer and plans for the performers are printed out.

The software needed to automate construction of the model and planning of management apparatus activity by using a computer has also been written.

8545
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ORGANIZATION OF INFORMATION BASE UNDER CONDITIONS OF DEVELOPMENT AND INTEGRATION OF AUTOMATED MANAGEMENT SYSTEMS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, Dec 86 pp 33-34

[Article by B. G. Klimov and V. I. Chirkov, engineers]

[Text] The automated management systems now in operation in tractor and agricultural machine building sector enterprises have well proved themselves, although in the majority of cases they are local systems.

The current and next five-year plans in the sector call for further development of automated management systems and transition to development of integrated systems; the base enterprises in which design solutions are to be developed have been determined.

The transition to a new, higher degree of automation should take into consideration both the experience gained and the mistakes made in developing automated management systems in the preceding periods. As practice shows, costs for design and introduction of large integrated management systems are rising significantly compared to costs for development of local systems. The increase is due primarily to additional costs for development of problems of integration of various components of systems. To reduce these costs, special attention should be paid to using type designs for these problems during the design of integrated management systems.

Proceeding from the integrated management system design structure in the area of organizing the extra-machine data base organization and management, the problems of hardware complex structure, organization of the intra-machine base, technological processes of information handling, software structure, teleprocessing facilities and inter-machine information exchange have to be solved.

The development of the data base organization and management, which is the foundation for an automated management system in any class, should especially be singled out.

In accordance with the local nature of the management systems developed in the machine building enterprises, the data base organization and management,

which enabled solving the limited range of functional problems making up a specific system, was also designed appropriately. For machine building enterprises, the most traditional sources of information in organizing the data base organization and management are the source documents containing information on the structural suitability of parts and assembly units in products, intershop processing routes for manufacture of parts and assembly units, labor standards by operation, material standards and various classification systems of economic and engineering information.

As a rule, documents prescribed by union-wide and sector engineering specifications were used as source document forms.

However, the information contained in these documents is insufficient to provide for efficient organization of document turnover on the intra-plant level when management processes are fully automated.

And when an existing management system is expanded, new input source documents are also introduced.

In connection with this, source document management is decentralized, information is duplicated because of repetition of individual indicators and fields in various documents, system validity and reliability is reduced, algorithms and software structure are unwarrantedly complicated and document turnover worsens. All this in the aggregate creates difficulties in introducing and operating the entire system as a whole.

The Pavlodar PKI ASU [Automated management System Design-Engineering Institute] developed a design for data base organization and management where the shortcomings made in developing local systems were taken into account. This design was based on an analysis of the data base organization and management used in the automated management systems functioning in the enterprises of the Ministry of Tractor and Agricultural Machine Building and other machine building sectors including in the Volga Motor Vehicle Plant.

The automated system developed for data base organization and management organizes the extra- and intra-machine management of information on the industrial manufacturing process suitability of parts and assembly units in products; inter-shop processing routes for making parts and assembly units; intra-shop routes for manufacturing and labor standards by operation; material standards; classification of parts, assembly units and products; classification of physical assets and others.

The information base is built not only with regard to the basic requirements imposed on systems in this class, but also provides additional capabilities which improve the quality of functioning of it.

The design developed to organize data base organization and management provides for changing the prevailing document turnover and centralizing management of source documents on the intra-plant level; the concept calls for filling out source documents once and subsequently managing them by machine.

To preclude information redundancy, each user is given only that nomenclature of information for a document which is necessary for his work.

The systems information base composition is determined by these source documents: Log of Manufacturing Process Routes for Family of Machines, Manufacturing Process and Labor Standards Chart, Change in Materials Consumption Standards by Part, and Change in Price List Classification System for Materials. The source document forms are shown in figures 1 to 4.

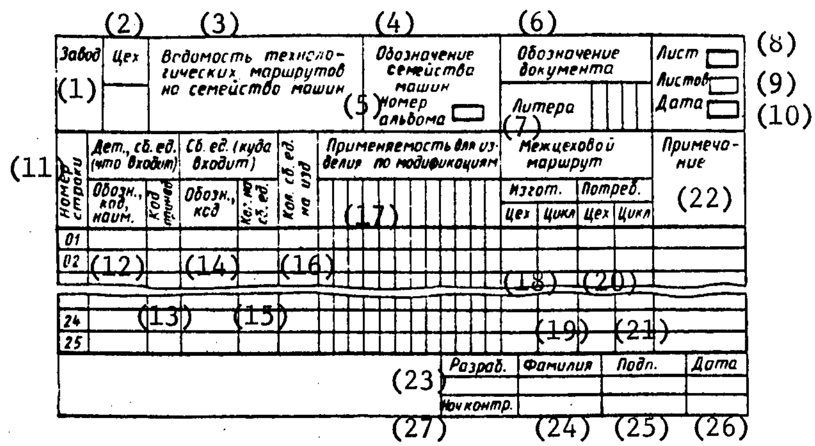

Fig. 1. Log of Manufacturing Process Routes for Family of Machines

Key:

1. Plant
2. Shop
3. Log of Manufacturing Process Routes for Family of Machines
4. Designation of family of machines
5. Diagram manual number
6. Document designation
7. Letter
8. Page
9. of Pages
10. Date
11. Line number: 01, 02 ... 24, 25

Part, assembly unit (what goes in):

12. Designation, code, name
13. Accessory code

Assembly Unit (where it goes):

14. Designation, code
15. Quantity per assembly unit
16. Quantity of assembly units per product
17. Suitability for product by modifications

Inter-shop route:

18. Manufacturing shop
19. Manufacturing cycle
20. Using shop
21. Using cycle
22. Remarks
23. Developer
24. Last Name
25. Signature
26. Date
27. Inspection chief

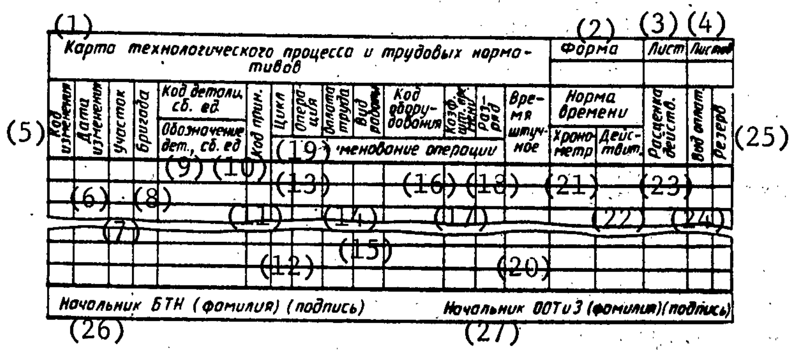

Fig. 2. Manufacturing Process and Labor Standards Chart

Key:

1. Manufacturing Process and Labor Standards Chart
2. Form
3. Page
4. of Pages
5. Change Code
6. Change Date
7. Section
8. Team
9. Part, assembly unit code
10. Part, assembly unit designation
11. Accessory code
12. Cycle
13. Operation
14. Payment for work
15. Type of work
16. Equipment code
17. Time per piece factor
18. Wage class
19. Operation code, name
20. Time per piece

Standard piece time:

21. Chronometer
22. Effective
23. Effective piece-rate price
24. Type of payment
25. Reserve
26. BTN [Engineering Standardization Office] Chief (last name) (signature)
27. OOTiZ [Labor and Wage Department] Chief (last name) (signature)

The document entitled Log of Manufacturing Process Routes for Family of Machines contains information which was previously found in these documents: Design Specification; Log of Parts and Assembly Units not Installable, but Affixable to a Product; Log of Inter-shop Manufacturing Process Routes; and Log of Manufacturing Process Adjustment of Product Composition.

The document entitled Manufacturing Process and Labor Standards Chart contains information which was previously entered by documents defined by the complex of YeSTD [Unified System of Manufacturing Process Documentation] standards and the document entitled Standard Piece Time and Piece-Rate Prices.

In the process, the unified document introduced provides information on automation of the traditional functions implemented by using documents from the

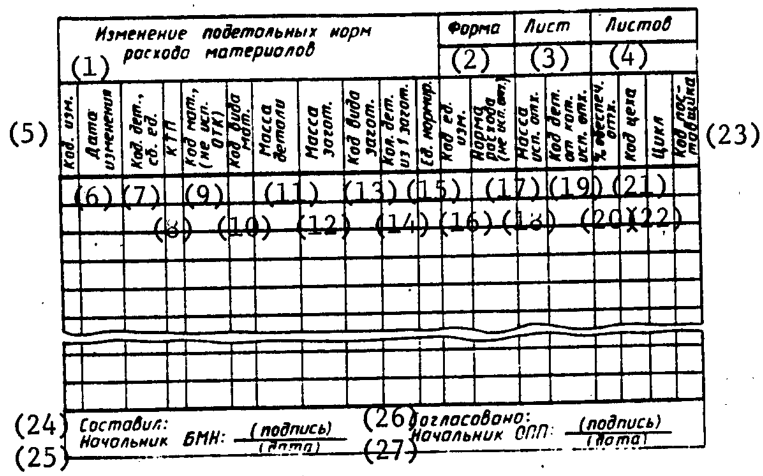

Fig. 3. Change in Materials Consumption Standards by Part

Key:

1. Change in Materials Consumption Standards by Part
2. Form
3. Page
4. of Pages
5. Change Code
6. Change Date
7. Part, assembly unit code
8. KTP [engineering control station]
9. Material code (not used by OTK [Engineering Inspection Department]
10. Material type code
11. Weight of part
12. Weight of blank
13. Blank type code
14. Number of parts per blank
15. Unit of standardization
16. Change unit code
17. Consumption standard (unusable scrap)
18. Weight of usable scrap
19. Code of part from which usable scrap
20. Percentage of provided scrap
21. Shop code
22. Cycle
23. Code of supplier
24. Compiled by:
25. BMN [Material Standardization Office] Chief (signature) (date)
26. Approved by:
27. OPP [Production Planning Department] Chief (signature) (date)

complex of YeSTD [Unified System of Manufacturing Process Documentation] standards and allows implementing the functions of planning, accounting and monitoring the course of production with the brigade form of labor organization and the transition of the enterprise to the new system of labor payment and incentives.

The document entitled Change in Material Consumption Standards by Part contains information which was previously entered by the set of documents: Chart for Standards of Consumption of Ferrous and Non-ferrous Metals and Pipes Specified by Part, Chart for Standards of Consumption of Polymer Materials Specified by Part, Chart for Standards of Consumption of Textile, Hemp-Jute and Paper Materials Specified by Part and others.

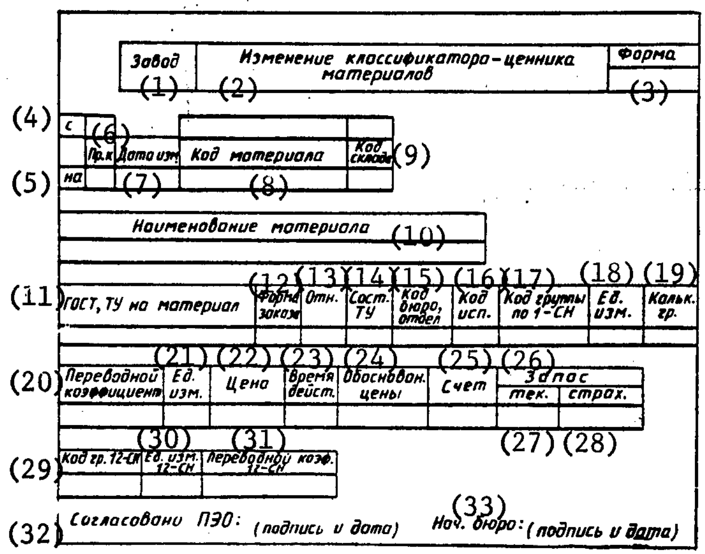

Fig. 4. Change in Price List Classification System for Materials

Key:

1. Plant
2. Change in Price List Classification System for Materials
3. Form
4. From
5. To
6. Pr. k.
7. Change date
8. Material code
9. Warehouse code
10. Material name
11. GOST [State Standard], TU [Engineering Specifications] for material
12. Order form
13. Otn.
14. TU [Engineering Specifications] compiler
15. Office, department code
16. Code of isp. [executor]
17. Code of group from 1-SN
18. Unit of change
19. kalk. gr.
20. Conversion factor
21. Unit of change
22. Price
23. Effective time
24. Substantiated prices
25. Bill
26. Stock
27. Tek. [current]
28. Strakh. [insurance]
29. 12-SN group code
30. 12-SN change unit
31. 12-SN conversion factor
32. Approved by PEO [Economic Planning Department]: (signature and date)
33. Office chief: (signature and date)

The document entitled Change in Price List Classification System for Materials has replaced these documents: Price List of Materials, Price List of Parts, List of Standards of Stocks of Materials, List of Standards of Stocks of Parts, Material Group Titles and others.

When a base is initially generated or updated, the information in these system documents undergoes checking during joint processing of them; this enhances the validity and reliability of the entire system.

As a result of the information processing, reports are output with the information necessary for a specific user.

Thus, the following reports are also output from the information in the document entitled Log of Manufacturing Process Routes for Family of Machines:

by groups of products (basic production, consumer goods, cooperative, etc.) for the PDO [production control department] and PEO [economic planning department] services engaged in management of production by a specific group of products;

by nomenclature of parts and assembly units for a specific shop participating in the production process and others.

From the information in the document entitled Manufacturing Process and Labor Standards Chart, these reports are also output: Log of Standard Piece Time and Piece-Rate Prices by the complete list of parts for a specific part, by production shops for employees in the BTZ [Engineering Specifications Office] and the OOTiZ [Labor and Wage Department], by manufacturing process and labor standards for a specific part (by all cycles of manufacture in the production shops or by an individual cycle for employees in the manufacturing process offices in the shops and the manufacturing process services in an enterprise); by nomenclature of parts made in specific production shops: by manufacturing cycles and by sections and brigades for employees in the BTZ [Engineering Specifications Office], the OOTiZ [Labor and Wage Department] and the manufacturing process offices in the production shops.

From the information in the document entitled Change in Material Consumption Standards by Part, the following reports are also output: Log of Material Consumption Standards by Part for a specific part for employees in the BMN [Material Standardization Office]; Log of Shop Material Consumption Standards by Part for a part by manufacturing cycles in production shops for employees in the BMN [Material Standardization Office] and manufacturing process offices in the shops; Log of Types of Materials with consumption standards and a list of the parts, in the manufacture of which they are used, for employees in the BMN [Material Standardization Office].

From the information in the document entitled Change in Price List Classification System for Materials, these reports are also output: by nomenclature of materials and parts for services in the OMTS [Materials and Equipment Supply Department], OVK [Incoming Inspection Office] and chief accountant engaged in problems of management by a specifically assigned group; by nomenclature of materials and parts allotted to a warehouse and others.

At the same time, a perforated file and changes to it are output for entry of conventional and constant features from the RI7501 information entry devices installed in the shops and warehouses.

Such a structure of a data base organization and management system has been introduced and is determined not only by the customary composition of automated functions. It allows incremental growth of functional system capabilities without hurting the information base in less time and with less cost.

8545
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AUTOMATION OF MODELING OF PART MACHINING PROCESSES

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, Dec 86 pp 31-32

[Article by L. A. Kopelevich and Ya. Z. Rolbin, engineers]

[Text] The 27th CPSU Congress set the tasks of substantially raising product quality, widely introducing electronics and comprehensively automating production before the industry of our country. The new business conditions dictate not only the necessity, but also the capability of enterprises to solve problems associated with quality control based on widespread introduction of computers and the methods of mathematical economics.

Product quality control is inextricably entwined with increasing the engineering level of production and control of the manufacturing process of machining which predetermines using computers in every possible way. The task of control is to ensure constant specified parameters, movement of equipment tools in accordance with the requirements of optimal technology and making the necessary adjustment when there is deviation from these requirements.

The main condition of optimal automatic control of a manufacturing process is that identification of the basic parameters of the process and the factors affecting it in which the control machine receives sufficient and timely information on changes occurring in the object and the procedure of actions to automatically make adjustments to normalize the causes of reduction in machining precision. Monitoring parameters in a manufacturing process control system should infer not only monitoring the quality of a product, but also supervising the basic manufacturing process factors affecting machining precision, conditions, etc. Modern measuring systems (scanners, recorders and other sensors) can perform this work; however widespread use of them is still being held up by design complexity, poor reliability, inadequate precision, and the necessity of a large number of instruments to obtain a systems representation of processes or even the difficulty of acquiring instruments.

The second major condition of optimal automatic control is obtaining current information on the values (status) of the manufacturing process factors.

Setting optimal conditions for the machining process can optionally be automated when the appropriate sensors for continuous monitoring of the

manufacturing process factors are available. To achieve stability of the controlled parameters, it is sufficient to have an adequate mathematical model which establishes the relations between the output parameters and the factors affecting them which are used to determine the necessary changes to the conditions. In recent years, some methods of machining precision control have been developed in the theory of automatic control; these methods are based on the apparatus of mathematical statistics and the theories of information, games and optimal filtration. However, many control problems have still not been fully solved. Existing methods allow identifying the machining process only in general form. In the scientific literature, there are no developments of models which consider the most prevalent case: the dominance of some component of the machining conditions. In this connection, it is important to stress the third condition needed to implement optimal automatic control: design of a serviceable mathematical model allowing identification of a manufacturing process both as a whole and when one factor (or a group of them) has a dominant effect.

Let us consider the task of designing such a model with respect to the conditions listed above for mass or large series production. The workpiece lathing process was selected as the object. The main controlled parameters (KP) are the outside geometric dimensions of the product being manufactured; these are the diameter, length and thickness of the sides and parts; the manufacturing process factors are cutting tool wear, temperature change and automatic machine tool adjustment (feed, cutting rate et al.).

For each of the controlled parameters $\nu \to (\overline{1, n})$ of workpieces at any random moment of the process t_i, estimates of the mathematical expectation $\hat{M}^{\nu}(t_i)$ and dispersion $\hat{D}^{\nu}(t_i)$ of a momentary sample can be obtained. The machining process model should be obtained as the set of moment statistical characteristics (mathematical expectations of these estimates and their dispersions):

$$M[\hat{M}^{\nu}(t_i)],\ M[\hat{D}^{\nu}(t_i),\ D[\hat{M}^{\nu}(t_i)],\ D[\hat{D}^{\nu}(t_i)],$$

defined for all classes into which the entire set of states of the process for each of the controlled parameters has been divided In doing so, by class $k \in (\overline{1, m_{\nu}})$ is meant the set of states for some controlled parameter, for which one of the significant factors U_{κ}^{ν} is dominant in the degree of its effect on machining precision. (Footnote 1) (V. I. Kantor et al., "Optimalnoye upravleniye tochnostyu obrabotki detaley v usloviyakh ASU" [Optimal Control of Precision of Machining of Parts under Conditions of an Automatic Control System], Moscow, Mashinostroyeniye, 1981, 253 pages). Consequently, the number of classes for some ν-th controlled parameter is the number of significant factors identified for it, i.e.

The machining process model, which is to be constructed, belongs to the stochastic class and is built with the moment characteristics of the controlled process; in doing so, obtaining estimates of moment characteristics is the main and specific task of identification of the controlled process.

What is new in the suggested approach is the identification of the machining process individually for each class of states under the conditions when there are no sensors for the values of the factors affecting the process or when it is impossible to measure them.

The following method of solving this problem is suggested.

Let there be identified as a result of experimental research of a part lathing process for some controlled parameter the m_ν of essential factors, i.e.

the causes capable of affecting the object of the study. Just as the machining process, the factors, in turn, are in the development the stochastic processes, the estimates of moment characteristics of which (mathematical expectation, dispersion, cross-correlation function) are determined experimentally when studying the machining process. For each controlled parameter for these moment characteristics, the theory of experiment planning (Footnote 2) (K. Hartman, E. Letskiy, V. Shefer et al., "Planning the Experiment in Research of Manufacturing Processes," translated from German, Moscow, Mir, 1977, 552 pages) can be used to construct multiple regression equations having the form

$$M\,[z^\nu_g/U^\nu_1, \ldots, U^\nu_{m_\nu}] = a^\nu_{0_g} + a^\nu_{1_g} U^\nu_1 + \ldots + a^\nu_{m_{\nu_g}} U^\nu_{m_{\nu_g}}, \quad (1)$$

where $g \in (\overline{1, 2})$, ; when g = 1, then z^ν_g is the estimate of the mathematical expectation, but when g = 2, then z^ν_g is the estimate of the dispersion of the moment sample for the ν-th controlled parameter; $U^\nu_1, \ldots, U^\nu_{m_\nu}$ are the factors affecting the ν-th controlled parameter; and $d^\nu_{0_g}, \ldots, d^\nu_{m_{\nu_g}}$ are the factors of the multiple regression equation for z^ν_g, found by using the theory of experiment planning.

Solving the problem of constructing a machining process model should also include consideration of the time factor, which is dictated by the necessity of measuring parameters at each control step.

Let us examine the machining process state at some random moment of time $t_i = i\Delta t$ (Δt is the control step or interval between two momentary samples). In doing so, each factor $U^\nu_j \left(j \in \overline{(1, m_\nu}\right)$ is found at that moment of time which can be characterized as the sum of two random values $\tau^\nu_j + t_i$,

where τ^ν_j is the interval of time from the start of the development of the j-th factor to the start of the process implementation in question, and t_i is the interval of time from the start of this implementation to the moment in question. (Footnote 3) (By implementation here is meant the course of the automatic machining process from one intervention into it to adjust the precision to another.)

Estimates of moment characteristics of each factor U_j^{ν} for each moment of time are known and are, respectively,

$$M[U_j^{\nu}(\tau_j^{\nu}+t_i)],\ D[U_j^{\nu}(\tau_j^{\nu}+t_i)],\ K[U_j^{\nu}(\tau_j^{\nu}+t_i)\times \times U_q^{\nu}(\tau_q^{\nu}+t_i)];$$

for each

$$j\in(\overline{1,m_{\nu}}),\quad q\in(\overline{1,m_{\nu}}),\quad q\neq j.$$

After applying the mathematical expectation operator to both parts of equation (1), at moment of time t_i, let us derive

$$M(z/\tau)=M[z_g^{\nu}(t_i)/\tau_1^{\nu},\ldots,\tau_{m_{\nu}}^{\nu}]=a_{0_g}^{\nu}+ + a_{1_g}^{\nu}M[U_1^{\nu}(\tau_1^{\nu}+t_i)]+\ldots+a_{m_{\nu_g}}^{\nu}M[U_{m_{\nu}}^{\nu}(\tau_{m_{\nu}}^{\nu}+t_i)],\quad (2)$$

where $M[z_g^{\nu}(t_i)/\tau_1^{\nu},\ldots,\tau_{m_{\nu}}^{\nu}]$

is the conditional mathematical expectation of the value of z_g^{ν} at time t_i

of the implementation of the process, the start of which is characterized by the corresponding state of the sampled factors at times $\tau_1^{\nu},\ldots,\tau_{m_{\nu}}^{\nu}$.

Using the known relation for a system of random values

$$D[y]=D[M(y/x)]+M[D(y/x)]\qquad (3)$$

and applying the dispersion operator to both parts of equation (1), we obtain in the case of the mutually independent factors $U_1^{\nu},\ldots,U_{m_{\nu}}^{\nu}$ the expression

$$D(z/\tau)=D[z_g^{\nu}(t_i)/\tau_1^{\nu},\ldots,\tau_{m_{\nu}}^{\nu}]= =D\left[M[z_g^{\nu}/U_1^{\nu},\ldots,U_{m_{\nu}}^{\nu}]\right]+M\left[D[z_g^{\nu}/U_1^{\nu},\ldots,U_{m_{\nu}}^{\nu}]\right]= =a_{1_g}^{\nu^2}D[U_1^{\nu}(\tau_1^{\nu}+t_i)]+\ldots+a_{m_{\nu_g}}^{\nu^2}D[U_{m_{\nu}}^{\nu}(\tau_{m_{\nu}}^{\nu}+t_i)]+ +M\left[D[z_g^{\nu}/U_1^{\nu},\ldots,U_{m_{\nu}}^{\nu}]\right],\qquad (4)$$

but with mutually dependent factors having cross-correlating functions of the form

$$K[U_j^{\nu}(t)\,U_q^{\nu}(t')],$$

$$D(z/\tau)=D[z_g^{\nu}(t_i)/\tau_1^{\nu},\ldots,\tau_{m_{\nu}}^{\nu}]= =D\left[M[z_g^{\nu}/U_1^{\nu},\ldots,U_{m_{\nu}}^{\nu}]\right]+M\left[D[z_g^{\nu}/U_1^{\nu},\ldots,U_{m_{\nu}}^{\nu}]\right]= =a_{1_g}^{\nu}D[U_1^{\nu}(\tau_1^{\nu}+t_i)]+\ldots+a_{m_{\nu_g}}^{\nu^2}D [U_{m_{\nu}}^{\nu}(\tau_{m_{\nu}}^{\nu}+t_i)]+2\sum_{j,q=1}^{m_{\nu}}\left(a_{j_g}^{\nu}a_{q_g}^{\nu}\cdot K[U_j^{\nu}(\tau_j^{\nu}+t_i)\times \times U_q^{\nu}(\tau_q^{\nu}+t_i)]\cdot\left[D[U_j^{\nu}(\tau_j^{\nu}+t_i)]\,D[U_q^{\nu}(\tau_q^{\nu}+t_i)]\right]^{1/2}+ +M\left[D[z_g^{\nu}/U_1^{\nu},\ldots,U_{m_{\nu}}^{\nu}]\right].\qquad (5)$$

From equations (2) and (4) or (2) and (5), the conditional moment characteristics for any random moment of implementation of a given machining process can be determined. Thus, the suggested model serves as an apparatus for identifying a machining process without an immediate change of value, but with regard to the effect of individual factors.

Computers are the basis for developing automatic and automated control systems; the Elektronika-60, SM-1800, Elektronika D3-28 et al. minicomputers may be used as processes to control machining precision. Using statistical information allows developing packages of standard application programs for machines in a given class. In connection with this, solving the machining process control problems posed requires a machine algorithm to identify them.

As additional terms for constructing an algorithm, let us introduce the concept of time slices, the values of which are determined in studying a specific machining process: $\tau^{\nu}_{j\,max}$ is the maximum time for development of the

factor U^{ν}_{j}, in which the percentage of a possible reject from the ν-th controlled parameter does not exceed the permissible level in the moment samples, irrespective of the state of the other factors; $\tau^{\nu}_{j\,крит}$ is the time

of development of the factor U^{ν}_{j}, in the course of which it is known that it can not be dominant; and t^{κ}_{max} is the maximally possible time for implementation of the machining process when the factor U^{ν}_{k}. is dominant.

The form of the law of distribution for values of τ^{ν}_{j} can be specified two ways: either determined experimentally in a study of a specific machining process, or assumed equally probable, which in a limited interval assumes the worst case for the modeling results.

Now, an algorithm constructed on the base of the method of statistical tests (Footnote 4) (Venttsel, Ye. S., "Issledovaniye operatsiy" [Operations Research], Moscow, Sovetskoye radio, 1972, 551 pages), can be used to obtain estimates of unconditional moment characteristics of a machining process $\widehat{M}_k[z^{\nu}_g(t_i)]$ and $\widehat{D}_k[z^{\nu}_g(t_i)]$ for each class of its state $k \in (\overline{1, m_{\nu}})$

at any point $t_i = i\Delta t$.

This solution of the stated problem raises the efficiency of using machine tools in view of the reduction of unproductive operation and optimization of machining modes; it increases product output and quality and reduces waste as a result of the parameters of machining approaching rated values.

Timely detection of the causes of deviations reduces the percentage of product rejects, which saves physical resources and tools and reduces product cost.

Computer implementation of an identification algorithm in a machining precision control system facilitates and accelerates adjustment of equipment, reduces adjuster skill requirements and in the final analysis reduces the labor shortage. A prototype identification algorithm has been implemented for a steel drill lathe bay at the Medinstrument NPO [Medical Instrument Industrial Science Association] (Kazan). Modeling was implemented in PL/1 (OS) for Unified System computers.

8545
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AUTOMATION OF HEALTH CENTER ACTIVITIES

Tbilisi ZARYA VOSTOKA in Russian 1 Feb 87 p 4

[Article by Valentina Nechayeva, programmer-engineer at the "Likani" basic sanatorium, under "Search, Research, Experiment" rubric: "A Computer Evaluates Work"]

[Text] "Elektronika BK-0010" is the way the computer installed at the "Likani" basic sanatorium is called. Important work on the automation of administrative-operating and treatment-diagnostic processes was begun here recently by means of it. The use of a computer will make it possible to create a flexible instructional information directory system for managing all the sanatorium's extensive facilities.

At the present time, only two tasks have been developed and introduced into practice in the computer for the time being. The first one of them is supervising the operational execution of an assignment that is given to anyone of the sanatorium's staff members. The accomplishment of a similar task is necessary in those large collectives, like ours, where it is extremely complicated to monitor the quality of work in a centralized manner and to study the dynamics of each staff member's labor activities. That is precisely why earlier the quality of work frequently was judged not on the basis of conducting systematic, extensive, and skilled analysis, but with regard to the presence or absence of complaints about one staff member or another. The use of a computer eliminates nonobjectivity in evaluating the activities of all the services of the health center.

So-called "urgent matters," "chief physician's notebook," and "results of rounds" type reference information files, which assist in solving daily operational problems in a practical manner, were created for accomplishing the second task. By means of display units the chief physician can supervise the entire work of the health center; obtain the necessary data; and, "consulting" with the EVM [computer], immediately solve problems that arise.

A large amount of information--which while analyzing, the computer is capable of prognosing and diagnosing illnesses and beginning treatment--will be loaded into the "Elektronika BK-0010" the same way, and it performs over 300,000 operations per second.

9889
CSO: 1863/280

DEVELOPMENT OF AUTOMATED ACCOUNTING SYSTEM FOR RAILWAYS

Moscow MOSKOVSKAYA PRAVDA in Russian 8 Apr 87 p 3

[Article by M. Keler: "Computer for an Accountant"]

[Text] A SYSTEM FOR THE AUTOMATION OF ACCOUNTING AT LINE ENTERPRISES OF RAILROADS WAS DEVELOPED AT THE MOSCOW INSTITUTE OF RAILWAY TRANSPORTATION ENGINEERS (MIIT).

It is no secret that during our age--the age of EVM [computers]--accountants still frequently count in the old manner on desk calculators, and even here and there on an abacus. At railway enterprises all calculations traditionally have been performed on large equipment--tabulating machines--which are serviced by several people--operators and mechanics.

The new system developed by MIIT scientists makes it possible to automate the calculation of labor and wages of railway workers and to release a considerable number of people employed in these operations.

"The automation system is a complex of programs in small computers," relates V. Dedov, chief of the MIIT scientific research laboratory. "Its use makes it possible to release accounting workers from monotonous operations that, in addition, require increased attention."

The impact from assimilation of the new system just for last year was 1,200 rubles of savings per 1,000 workers, and there are millions of people working in railway transportation.

It is apparent that the development is profitable. But this is what is disturbing: there is a total of 138 computer installations on the railroads, but the new system has been assimilated at only 22. What is hindering utilization of the new development? It is more proper to ask who is hindering it? And here is the answer: the customer--the All-Union Trust for the Organization and Mechanization of Accounting in Railway Transportation "Transorgmashuchet." It is precisely there that they should have trained personnel for working on computers and created an organization that would have been involved in the maintenance and assimilation of software, but...

The order on creating an organization like this has been signed already too, and more than once MIIT has appealed to V. Zirka, chief of the trust, to no use whatever. As before, there are neither personnel for working on the computers nor a standard authorized schedule. As before, accountants on the lines have to dejectedly rotate the handle of a desk calculator.

9889
CSO: 1863/280

COMPUTER-AIDED DESIGN SYSTEM USED IN NORM SETTING

Moscow MOSKOVSKAYA PRAVDA in Russian 25 Apr 87 p 1

[Article by L. Bakhtina: "A Computer Calculates Norms"]

[Text] The "norm setting SAPR" computer-aided design system saves the Moscow production association "Geofizpribor" [Geophysics Instruments] nearly 20,000 rubles annually.

A total of five people are working at the industrial standardization bureau of the enterprise's machine shop. And the load is very great: the shop produces small series products and the products list is continually being updated. Over 5,000 product listings, with which high precision instruments--equipment for seismic prospecting, complex geophysical equipment, oil exploration installations--are fully equipped, are being handled simultaneously here. The small collective of rate setters has to keep nearly 20,000 industrial operations constantly under control.

Norms for the production of each product are put on operational flow charts. Compiling them is not a complex matter, but it is a very scrupulous one.

"Previously I spent half a day on calculating the norms for one machine tool operation. If precise, then it was 210 minutes," says L. Kraynova, the machine shop's rate setter-process engineer. "But now it is about 20-30 minutes, depending on the complexity and newness of a component. An EVM [computer] performs the most labor-intensive operations."

The labor productivity of the rate setters increased seven to eightfold with assimilation of the "norm setting SAPR." Expenditures on production preparation were reduced.

9889
CSO: 1863/280

REVIEW OF BOOK ON PLANNING OF PRODUCTION UNDER AUTOMATED SYSTEMS MANAGEMENT

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian Vol 22 No 4, Jul-Aug 1986 pp 755-756

[Review by V. I. Danilin of book "Production Planning under Conditions of Automated Systems Management (a Handbook)" by K. F. Efetova, T. P. Podchasova, V. M. Portugal, and B. E. Trinchuk, Tekhnika, Kiev, 1984, 135 pp]

Well-known works on the questions of improving the methodology of planning shed light, as a rule, on separate views of planning under conditions of the functioning of automated management systems, and give greater attention to the theoretical aspects of the problem than to the requirements of production. At the same time, for the past decade considerable experience has been accumuklated in the use of mathematical methods in planning, thanks to which the possibility has appeared to generalize them and formulate recommendations for ASU designers and economists at industrial enterprises.

The indicated circumstances make the current handbook under review very timely. It summarizes this attempt and is addressed to a wide circle of readers -- "users" of economic and mathematical methods in planning The merit of this book is in its overall consideration of all aspects of planning, beginning from the long-range, and ending with the daily-shift aspect, in correspondence with which it is divided into seven chapters.

Chapter 1 reveals in detail mathematical methods which are employed in long-range planning of plant activity, whose role is constantly increasing in the current period. For its implementation are presented methods of technical and economic calculations, extrapolation methods, multivariate correlation and regression analysis, expert evaluations, and so forth. Unfortunately, the handbook lacks a description of a large class of optimizing models, based on a normative approach and which are used in the development of five-year plans. (Footnote) (These models are seen for example in "Economic and Mathematical Models in a System for Plant Management," Moscow, Nauka, 1983.)

The book describes current planning at a plant, its interconnection with the five-year plan and long-range planning, and the models applied in practice (Chapter 2). Models are examined in detail for formulation of sectional divisions of the industrial manufacturing finance plan, in particular production planning, but at the same time a series of its divisions (for

example financial planning) are not at all in the field of sight of the authors. The book reflects the experience of subsystems of the technical and economic planning at a series of leading plants of the country.

Models for formulation of the production program of the plant occupy a special place. For convenience of use they are classified according to the types of production, the duration of the product manufacturing cycle, and the conditions for the realization of production. However, this classification of these models is not carried out from the point of view of the factors considered in them, which somewhat lessens the completeness of their description.

Here, however, is characterized the information base for the tasks of on-going production planning. All data necessary for consideration of the plan is divided into three sorts: the normative; data regarding the capabilities for production in the base period; and the general system data. The basic attention is allotted to the creation of a normative basis for calculating the variants of the plan. This section, in our opinion, is one of the most interesting and useful.

The significance of the normative basis for planning is generally well known. The handbook describes the content, organization of the on-going renovation, and methodology of deriving each group of norms. The material appears sufficiently general and can provide substantial assistance to drafters of current planning systems at various types of plants.

Likewise, it looks in detail at operational production planning for them (Chapter 3). It provides a schema of an operational production planning system, and analyzes in detail the factors which influence the choice of a planning system and the indicators which define the production type. This chapter permits the categorization of each model, presented in the subsequent chapters, in the general scheme of operational production planning.

The handbook illuminates the properties of automation of inter-shop planning (Chapter 4). The authors present a series of recently obtained original results: the choice of a planned accounting unit for inter-shop planning, the refinement of the list of its tasks, and the development of their models. Great attention is given to models of the given type of planning for various types of production, and to the corresponding standard applications program packages.

For the description of an automated system of intra-shop planning (Chapter 5), the book gives a detailed overview of the task of constructing accounting plans, and carrying out analysis and operational management of the course of production. Besides the models of formulation of a production program and calendar planning of the work sections and so forth, there are likewise described applications program packages which implement the intra-shop planning. Special attention is given to questions of calendar planning of production, and the more typical tasks and algorithms for its solution. (Chapter 6). Various preference functions and their classification, proposed for the solution of the practical problems of composing calendar plans on a computer, are expounded in detail.

In chapters 4 to 6, models of operational production planning are analyzed, yet in a practical sense no attention is given to questions of constructing combinations of economic-mathematical models on their basis, but this appears at the present time to be the fundamental direction of modeling planning activity. The choice of a subsystem of management for production engineering and for material-technical supply (Chapter 7) presents a definite item of interest. Here the book illuminates the principles of creating adaptive systems of production engineering and the organization of a system of planning and operational regulation of the material-technical supply; but less fully than, for example, the annual and operational production planning. The authors were limited by a very limited list of the most important times of modeling these subsystems.

Evaluating the book in its entirety, one can affirm that it has succeeded in systematically presenting a great amount of material about modeling planning activity at a plant, and in combining the necessary theoretical depth with the practical direction of the exposition. In our opinion, the handbook allows one to pick up the model (or models) of planning appropriate to every point of view and choose for it (them) standard software in the majority of cases. The book is well formulated, supplied with a wide list of recommended literature. Undoubtedly it will prove useful to specialists engaged in the questions of planning production.

13264
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UDC 532.529.5

MOVEMENT OF FLUID IN CHANNELS OF SMALL CROSS SECTION, ACCOMPANIED BY HEAT TRANSFER AND SEDIMENTATION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 290, No 3, 1986
(manuscript received 4 May 85) pp 564-566

[Article by V. M. Yentov, K. P. Ivanov, A. A. Karpov, N. F. Morozov and V. Ya. Rivkind, Leningrad State University imeni A. A. Zhdanov]

[Abstract] A study is made of mathematical models of processes observed in channels of small cross section such as deposition of impurities and precipitation of salts. It is assumed that the flow of the fluid is a film flow, i.e., the layer of fluid is thin and the flow is laminar, and that the problem is axisymmetrical, the flow of the fluid occurring through a cylindrical slot. The distribution of concentrations and temperature through the thickness of the film is assumed uniform and diffusion and heat conduction in the direction of motion are ignored. The numerical experiment shows that there is a time during which the hydrodynamics of the process and thermal phenomena stabilize, the time dependent on initial temperature, material and slot height. The zone of sedimentation is always located near the end of the meniscus, shifting closer to the slot with higher initial temperature, occupying less area but being greater in height as temperature rises. Temperature distribution through the meniscus is parabolic with a minimum point about 40% down the meniscus from its origin. Figures 2; references: 1 Russian.

6508/9835
CSO: 1863/220

DEVELOPMENT OF AUTOMATIC TELEGRAPH PROCESSING SYSTEM

Moscow MOSKOVSKAYA PRAVDA in Russian 3 Feb 87 p 1

[Article by F. Danilovskiy: "A Computer in a Telegraph Office"]

[Text] FACT. SCIENTISTS AND ENGINEERS OF THE MOSCOW COMMUNICATIONS ELECTRICAL ENGINEERING INSTITUTE (MEIS) HAVE DEVELOPED A SYSTEM FOR INTEGRATED AUTOMATIC PROCESSING OF TELEGRAPH MESSAGES (SKAT).

COMMENTARY. Muscovites receive more than 120,000 telegrams every day. It is quite clear that such a number of messages would not be sent without modern technology. Today computers that increase the operating effectiveness of the mail are the basis of it. For example, the "Telegraf" automatic message receipt and dispatch complex is operating successfully at the Moscow Telegraph Office.

If previously they came in to the teletype equipment by means of communications channels, and then were transmitted to a computer in the form of perforated tape, then now information from the various corners of our country is sent directly to an EVM [computer]. It analyzes the telegraph messages received and, having read the postal routing code, in a very few seconds sends the telegram to one Moscow branch communications office or another. But what if the sender of the message forgot to indicate the addressee's routing code? Then, straining its electronic memory, the computer endeavors to find the necessary routing code.

A computer will soon become the main shape of the telegraph office. Specialists are developing an original message transmission system that connects the computers of the branch communications offices to a single network throughout the entire territory of our country. As a result, the information transmission rate will increase considerably, and expenditures on the processing of incoming telegrams will be reduced. The first steps in this direction have already been made. The municipal telegraph network in Moscow is being modernized, and telegraph messages will be transmitted four times faster with the new equipment being put into service.

But just what is telegraph equipment? As a matter of fact, its design has changed little since 1832 when P. L. Shilling tested a device in Russia for electrical telegraph messages. However, one has only to connect a microcomputer to it, and the telegraph equipment will find its second youth. It will be able

to operate with five-channel and seven-channel codes, and it will become rapidly "accustomed" to the different transmission rates, easily retaining them in its memory.

While improving the design of the equipment, the "Skat" system was developed at MEIS that took upon itself the integrated automatic processing of telegraph messages. The basis of it are a video terminal that resembles an ordinary television set, a console with a keyboard that an operator uses to compose the text, and a special printer as well. The new system automates the receipt and dispatch processes of a telegram. An operator needs only half a minute to prepare it. The text of a message and the recipient's address, which are composed by means of the keyboard, are sent to a computer that indicates this information on a display unit and, having retained them in its memory, the computer transmits them to the addressee. The "Skat" is connected to the "Telegraf" complex, forming a completely automated communications system. As testing has shown, the development significantly increases the labor productivity of telegraph operators, and it improves their working conditions. In this regard, the quality of receiving and dispatching telegrams is improved and their processing time is reduced. The assimilation of computer equipment at branch communications offices will assist in delivering correspondence more rapidly to Muscovites.

9889
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PROBLEMS IN AUTOMATION OF TELEGRAPH COMMUNICATIONS

Moscow MOSKOVSKAYA PRAVDA in Russian 5 Mar 87 p 2

[Article by F. Danilovskiy under "Science and Technical Progress" rubric: "What Does the Telegraph Office Urgently Need?"]

[Text] The stormy development of computer technology did not avoid telegraph communications either. It is doubtful that Emile Baudot, the Paris telegraph office mechanic who in 1876 invented the equipment that is well-known to the whole world, could imagine what the communications equipment of our day would become. Now a computer occupies a worthy place in the "Telegraf" automated complex at the capital's central telegraph office. An EVM [computer] rapidly and efficiently sends streams of messages from various corners of the country to the necessary information channel, while increasing the labor productivity of telegraph operators and improving the quality of service to the public.

It is not necessary to speak about the fact that the automation of telegraph communications is needed. The thing is that the quality of domestic equipment at the central telegraph office leaves much to be desired and its reliability, to put it mildly, is low.

"Basically, imported telegraph equipment meets our demands," says V. A. Stryapushkin, deputy chief engineer of the central telegraph office. "Unfortunately, the domestic RTA-80 equipment is often out of service. And I am already tired of talking about the low quality of the paper and inking ribbon."

Specialists of the central telegraph office are endeavoring to improve the existing equipment. With their participation an original system for automating the receipt of telegrams by telephone is being put in operation in Moscow. If previously an operator receiving a subscriber's message first wrote it down and then gave it to the telegraph operators for transmission to the necessary branch communications office, then now a computer has taken many operations upon itself. The text of a telegram is composed on a keyboard and sent to the screen of a display unit. Having "read" the message, the computer stores it in its memory and transmits it to the addressee. The labor productivity of the operators thereby increased by 30 percent, and there will be far less errors in the text too. And then the number of telegrams that can be received per unit of time will increase. This is quite important; after all, for example, nearly 5,000 of them come in by telephone during holidays.

The use of a computer system for the instantaneous receipt of telegrams by telephone is in the future. Now a subscriber must wait for confirmation of the fact that the telegram was received. In the future, messages will begin to be sent to the necessary branch office immediately. And if the subscriber wants to change the contents of the telegram, it will be simple to do this, editing the text on the screen of the display unit.

As you see, computer equipment is a guarantee in automating the labor of telegraph operators, but, in order to accelerate the assimilation of advanced labor methods, production workers must have the support of scientists and practical assistance in creating new equipment. For the time being it is not necessary to count on assistance like this. In a real sense neither the scientists of the Moscow Communications Electrical Engineering Institute nor the specialists of other scientific subunits [podrazdeleniye] wish to turn to the needs of the telegraph office.

The inability to consider the actual demands of production frequently leads to the fact that "new" developments are already obsolete during the research stage. For example, specialists from the Central Communications Scientific Research Institute (TsNIIS) proposed a message switching center to telegraph operators which was created on the basis of a computer that had been removed from production.

Even if this institute cannot engender fruitful technical ideas, it could at least listen to the production workers' recommendations. Not so long ago specialists from the central telegraph office turned to TsNIIS with an interesting proposal. The essence of it is that it is possible to reduce the number of so-called service words in a telegram by means of special equipment and software. As a matter of fact, there are even more and more of them with the assimilation of computers, and as a result the work of telegraph operators is becoming complicated and special training is required for them. The proposal will help in facilitating the operators' work and avoiding errors in the preparation of data for the computer.

But the idea was met without enthusiasm at TsNIIS. The matter never got any farther than conversations about the fact that it would be necessary to discuss it. But the assistance of scientists was necessary for wide assimilation of the new method. Incidentally, how do they evaluate their contribution to automation of the telegraph office?

"Our institute is doing important work in the creation of automated systems for the receipt and dispatch of telegraph messages," relates V. P. Lepikov, chief of the TsNIIS laboratory. "I think that the telegraph operators are satisfied with our developments. As to the idea of the central telegraph office specialists regarding a reduction in the service words of a telegram, it has not been analyzed in detail by me and, probably, other staff members of our institute are involved with it, although there is nothing new in it."

YOU AGREE THAT A SIMILAR "CREATIVE" APPROACH TO PRODUCTION WORKERS' PROPOSALS DOES NOT FACILITATE SCIENTIFIC TECHNICAL PROGRESS AT ALL. HOW THEN CAN ONE BE IN THE FOREMOST ADVANCES OF SCIENCE BEFORE STRIVING! IT IS EASIER TO BE ENGAGED

FOR YEARS IN RESEARCH THAT DOES NOT REQUIRE BUSINESSLIKE INITIATIVE AND ACTIVE OPERATIONS. INDEED, THIS IS TROUBLESOME TOO--BESIDES QUIETLY WORKING ON A SUBJECT APPROVED BY THE AUTHORITIES, TO PUT ON ONESELF EVEN MORE THE REALIZATION OF A "STRANGE" IDEA. AND NATURALLY IT TURNS OUT THAT DOMESTIC TELEGRAPH EQUIPMENT IN MANY RESPECTS IS INFERIOR TO IMPORTED EQUIPMENT, AND MICROCOMPUTERS--WHICH HAVE JUST COME INTO BEING--CANNOT COMPETE WITH FOREIGN MODELS OF 10 YEARS STANDING. AND WHEN THE PROBLEM IS STATED LIKE THIS, IT IS DIFFICULT TO SPEAK SERIOUSLY ABOUT THE COMPUTER RETOOLING OF TELEGRAPH COMMUNICATIONS ENTERPRISES.

9889
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CHILDREN'S COMPUTER CLUB STARTED IN MOSCOW

Moscow NTR: PROBLEMY I RESHENIY in Russian No 12, 17 Jun-7 Jul 86 p 2

[Article by S. Khozin entitled "Informatika to Youth: Four Microcomputers on the Doorstep of 'Kompyuter']

[Abstract] The new "Computer" club was founded June 4, 1986 in Moscow, at the "Nash Arbat" social club, for children at least six years old. The chairman is Garri Kasparov, world chess champion. Speaking at the establishment were Kasparov; Ye. P. Velikhov, Vice-President of the USSR Academy of Sciences; S. A. Pachikov, co-worker of the workers' advisory group; and A. Yu. Uvarov, Director of Informatics and Computer Technology of the Ministry of Education.

Also present were representatives of the city Komsomol committee, and some foreign guests, including Diane Miller of the English "Gerald" firm, which donated several computers such as the CPC-464 and CPC-6128. In a question and answer period, Uvarov admitted that there have been quality control problems in domestically produced Agat computers; children have had to be trained to fix the keyboards themselves before being able to use the machines. The Ministry of the Radio Industry, which is the basic supplier of computers for the schools, has received many complaints from Uvarov's group, and sometimes has cast a pall over introducing the little ones to computers. He also stated that informatics is being taught only in the older classes but being prepared for 5th to 8th graders. This club is a component of computer education.

13264
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MODERN COMPUTERS: EQUIPMENT AND PRACTICAL USE

Moscow NOVOYE V ZHIZNI, NAUKE, TEKNIKE: SERIYA TEKHNIKA (SOVREMENNYYE KOMPUTERY: USTROYSTVO I PRAKTIKA ISPOLZOVANIYA) in Russian No 3, 86 pp 1-2, 62

[Annotation from the book "Modern Computers: Equipment and Practical Use, Tekhnika No 3, Izdatelstvo "Znaniye", Moscow 1986, 45,640 copies]

[Text] Annotation

Increasing production at this time without the introduction of computer technology is inconceivable. Various computers, their versatility, constantly decreasing prices, rapidity of response, and adaptability, as well as their place and role in the social development of society, are the topics discussed in this booklet.

12863/9835
CSO: 1863/118

TENTH ALL-UNION CONFERENCE ON PROBLEMS OF MANAGEMENT

Alma-Ata VESTNIK AKADEMII NAUK KAZAKSKOY SSR in Russian No 1, Jan 87 pp 80-82

[Article by Doctor of Technical Sciences A. A. Ashimov and Candidate of Technical Sciences B. A. Dzhaparov]

[Text] The tenth All Union Conference on Control Problems was held in Alma-Ata on 29 September-3 October, 1986. The conference was organized by the Academy of Sciences of the USSR, the Academy of Sciences of the Kazakh SSR, the National Committee of the USSR on Automatic Control, the Ministry of Higher and Secondary Specialized Education of the Kazakh SSR, the Institute of Control Problems, the Kazakh Polytechnical Institute imeni Lenin, and the Institute of Mathematics and Mechanics of the Academy of Sciences of the Kazakh SSR.

The conference caused great interest in the scientific community of teachers of higher educational institutions, leaders of industry and engineers. More than 1,000 specialists from 73 USSR cities took part in the conference. The opening of the conference took place on 29 September 1986 in the republic's Russian Dramatic Theatre imeni Lermontov. The opening address of the chairman of the National Committee of the USSR on Automatic Control and of the organizing committee of the conference, the academician V. A. Trapeznikov, was read by the deputy chairman of the committee N. A. Kuznetsov. The address noted the significance of the conference for the development of the science of control. Particularly important goals were formulated. The address stressed the necessity for a concentrated effort in key areas and a prioritized development of fundamental research, and also for applied efforts to distribute the most successful systems with the goal of minimizing the waiting period before the practical application of the scientific results.

The president of the Khazakhstan Academy of Sciences, the academician M. A. Aytkhozhin addressed the participants of the conference with an opening greeting from the Central Committee of the Communist Party of Kazakhstan and the government of the republic.

The learned secretary of the organizing committee, B. A. Dzhaparov, informed the participants of the conference of the essential points, the order of tasks and other information. The structure of the scientific program and the order of activities were planned on the basis of the previous conference held in

Yerevan in November, 1983. During the course of the conference, there were about 40 plenary reports, 8 lectures, 4 discussions and more than 450 wall reports. They covered the complete spectrum of problems of the theories of control. They contained numerous practical applications of the results of theory.

The report of academician A. G. Aganbegyan, "The Structure of Mechanisms for Economic Control Under New Conditions," caused great interest among all the participants of the conference. The report dealt with the basic stages of the direction of reorganization of the economic mechanism during the course of intensification. The report of the chairman for the Kazakh regional group of the USSR National Committee on Automatic Control, A. A. Ashimov, "Development of the Science of Control in Kazakhstan" was indicative of the large contribution from scientists of the republic in the development of various divisions of theories of control and their practical applications.

A special plenary meeting was devoted to problems of automatizing design, robotization and flexible automated production. The academician Ye. A. Fedosov opened the meeting with the report "The Automation of the Design of Integrated Production Installations and Their Control Systems." B. L. Kuleshov, gave a joint report with corresponding member of the USSR Academy of Sciences, I. M. Makarov, "Robotics and Flexible Automated Production" and N.A. Kuznetsov spoke on "Automation of the Design of Control Systems of Production Units."

The speeches of member correspondents of the USSR Academy of Sciences D. E. Oxotsimskiy, "Adaptive Control of a Robot Using the Simplest Means of Sensing," and L. I. Volchkevich, "Problems in the Development of Flexible Automated Production," also were related to the subjects enumerated above.

The report of the academician N. N. Moiseyev "Models to Analyze Management of the Environment," examined various aspects of the interactions of man with nature from a realistic position.

The reports of V. A. Kaminiskas, "Adaptive Control of Processes in Power Installations," and M. V. Meyerov, "The Oil-Refining Industry as a Multi-Connection Entity and the Problem of Optimal Control," were devoted to problems of Control in power engineering.

A lot of attention at the conference was given to the question of the development of computing and its application in control processes, which was examined in the reports of A. L. Kazmin and A. A. Menn, "Systems of Modelling and Automated Design of Software of Distributed Controlled Complexes", Z. A. Traxtengertz and Ye. V. Shcherbakov, "Methods of Creating Software for Multiprocess Computers (e.g., PS3000)," L. D. Raykov, K. A. Larionov and A. P. Gagarin, "Perspectives on the Development of Software (YeS Computers)," and V. A. Zhozhikashvili and V. M. Vishnevskiy "Automating the Process of Design of Computer Information Networks."

The reports of corresponding member of the USSR Academy of Sciences Ya. Z. Tsypkin and B. T. Polyak, "New Directions in the Theory of Data

Processing and Management," the academician A. A. Voronov and Yu. S. Popkov "Theory of Macrosystems and Control of Transport Flows," corresponding member of the USSR Academy of Sciences, A. A. Krasovskiy, "Forecasting and Optimal Automatic Control," and corresponding member of the USSR Academy of Sciences V. M. Matrosov "The Technology of Sovling Problems on the Basis of a Suite of Program Packages" were devoted to fundamental theoretical findings.

I. A. Ryabinin and B. G. Volik discussed the questions of the reliability, robustness, and safety of automated complexes, G. N. Cherkesov - methods of evaluating the robustness of complex systems with long-term autonomous functioning. G. R. Gromov's report "National Information Resources" drew the interest of the participants of the conference.

A number of reports dealt with theoretical and methodological questions of building automated control systems on various levels. The reports of U. A. Tukeyev "Automation of the Designing of Databases and Program Complexes of ASU of Continuous Technological Complexes, M. O. Klimovitskiy "Algorithm and Software Complexes of ASU of Technological Processes in Metallurgy."

The following reports were devoted to various aspects of control theory: V. F. Krotov, "Problems of Applications of the Theory of Optimal Control in Technical and Economic Systems," A. A. Pervozvanskiy "Theory of Disturbance in Problems of Optimal Control," Yu. N. Pavlovskiy and G. N. Yakovenko "Theoretical Group Methods in Control Theory," Ye. S. Pyatnitskiy "Methods of Synthesis of Nonlinear Control Systems," B. A. Berezovskiy and A. V. Gnedin "Selection from Random Manifestations," V. N. Vapnik "On Inductive Principles of Statistics," V. B. Kolmanovskiy and V. R. Nosov "Methods of Analysis of Systems with Consequences," Yu. I. Samoylenko "Problems of Control of Microprocessors in Extreme Environments," V. V. Velechenko "Non-local Variational Analysis of Distributed Systems."

Along with the plenary reports, lectures drew great attention which were intended to cost light on new perspectives of directions in science: academicians Yu. V. Gulyayev, F. F. Godik, A. M. Taratorkin, and S. A. Platonov "Physical Fields of Biological Entities as a Carrier of Information About Their Functional Structure," Yu. M. Svirezhev "Control of Ecological Systems," M. A. Ayzerman "Theory of Voting as a Method of Decision-making by the Collective (survey of Problems and New Questions," L. I. Rozonoer "Thermodynamic Aspects of Control Processes," A. V. Pokrovskiy and M. A. Krasnoselsk "Functional Analysis and the Dynamics of Control Systems," V. I. Yutkin "Sliding Modes in Distributed Systems," A. M. Petrovskiy "Models of Control in Medicine and Public Health" and I. I. Malashinin "Dialog Systems in Control of Scienctific Experiments."

The following four discussions took place during the course of the conference: "Decompositional Methods of Control of Complex Dynamic Units" (led by A. A. Pervozvanskiy and V. I. Yutkin), "The Science of Management and the Economic Mechanism" (by V. N. Burkov), "The Reliability, Robustness, and Safety of Automated Complexes" (by I. A. Ryabinin and V. G. Volik), and "The Principle of Mathematical Modelling in Control Problems" (by I. D. Kochubiyevskiy).

Wall reports were an extremely important component of the scientific curriculum of the conference. They reflected actual results in all areas of theory and techniques of control. More than 450 wall reports were presented and discussed. They were divided into four groups, including 23 topics.

1. THEORY OF CONTROLLED PROCESSES

Qualitative Analysis of Processes of Control

Optimal control stochastic systems
Identification
Adaptive control
Theory of selection
Logical control
Processing large files of information

2. METHODS OF IMPLEMENTING CONTROL SYSTEMS

Architecture and software of control computer systems
Components and devices of control systems
Reliability, robustness and diagnostics
Computer networks

3. PROBLEM ORIENTED CONTROL SYSTEMS

Methodology of building
Developing large scale systems
Transport
Robots
Flexible manufacturing systems (GPS)
Movement of entities
Socio-economic systems
Medical biological entities
Agricultural production and ecology
Modelling and automation of scientific experiments

4. AUTOMATED DESIGN SYSTEMS

Many wall reports caused lively discussion. A general discussion of reports was organized under the direction of leading specialists in a number of areas. The results of the discussions and the reviews of the wall reports will be analyzed and studied to determine basic trends as well as to develop programs for future conferences.

During the conference a number of leading specialists gave lectures and question-answer talks in Alma Ata. State television produced a number of popular scientific and educational broadcasts.

At the conference a meeting of the USSR National Committee on Control Problems took place with the participation of the directors of the regional groups. Various aspects of the coordination of the activities of the nation's scientists were discussed at the meeting.

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- END -